ELECTRICAL REVIEW

JULY 1954 ONE SHILLING

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JUL 17 1954
DETROIT

B T-H RESEARCH

B T-H ENGINEERING

B T-H MANUFACTURE

B T-H SERVICE . . .

mall wonder

Mazda lamps

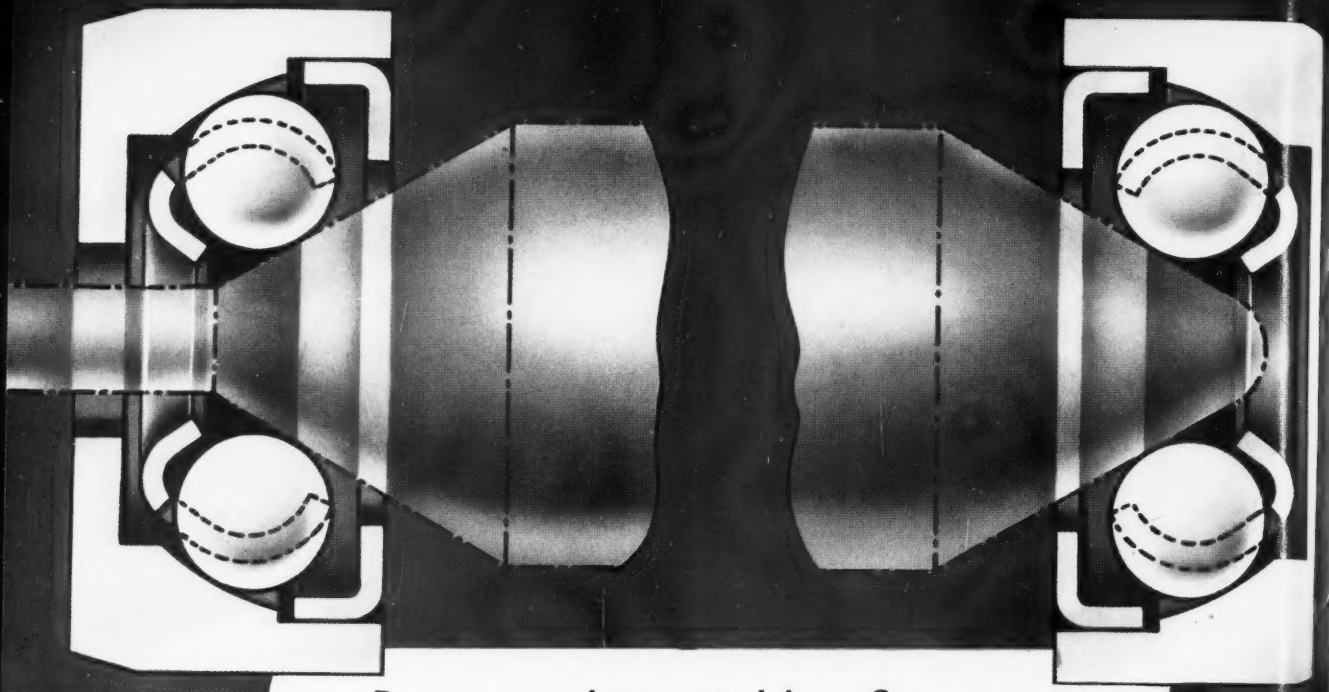
stay brighter longer

M4516

THE BRITISH THOMSON-HOUSTON CO. LTD., Crown House, Aldwych, London, W.C.2

(*Member of the A.E.I. Group of Companies*)

40 TIMES FULL SIZE



Register that trickle of current

Meters with bearings having appreciable static friction can miss a lot of revenue.

F.B.C. miniature ball bearings are now at the disposal of meter manufacturers in a range of sizes: they have extremely low starting and running friction.

The section above shows, enlarged 40 times, a bearing 2·5 mm. O.D. The simple straight tapers for the inner contact can be easily ground by the meter manufacturer on his own spindles, which can thus incorporate individual features needed in the instrument. The outer race has a spherical self-aligning track, so that some degree of error in the frame of the instrument is accommodated.

The sizes range from 1·5 mm. O.D. to 10 mm. O.D., and the open cup (see left above) will clear spindle extensions ranging from 0·25 to 2 mm. according to the size of bearing.

Fuller particulars and sizes are available on application.

SOME BEARINGS, ACTUAL SIZE

FISCHER BEARINGS COMPANY LIMITED, WOLVERHAMPTON

Fischer Bearings Company Ltd., and Timken-Fischer Stockists Ltd., Birmingham, are both subsidiaries of British Timken Ltd.

FBC TRADE MARK

ALL-BRITISH

F.B.C. :: FISCHER

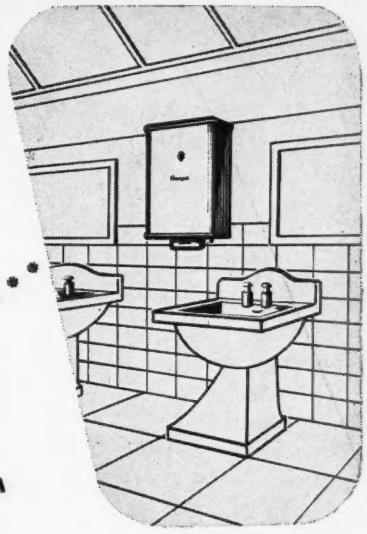
BALL AND PARALLEL-ROLLER BEARINGS

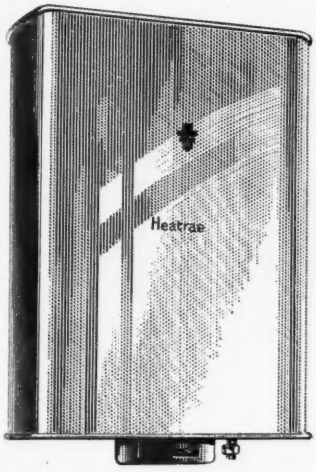
R v.155 pt.1 Jy-Ag '54

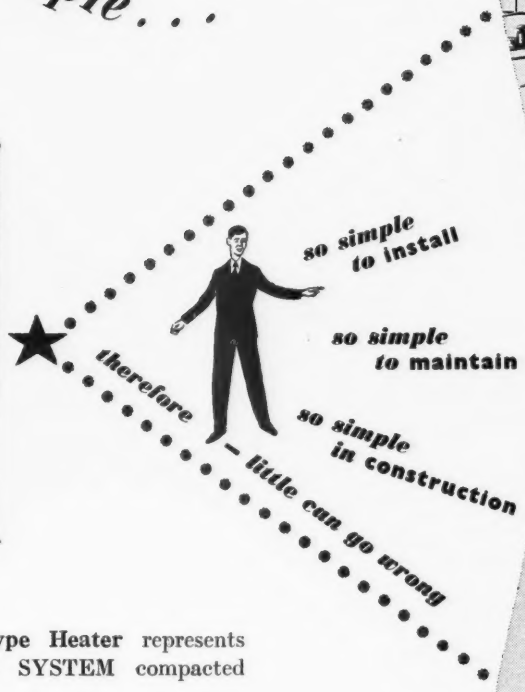
Simplicity—The Hallmark of Genius....

Heatrae *electric water heaters*

are so simple...



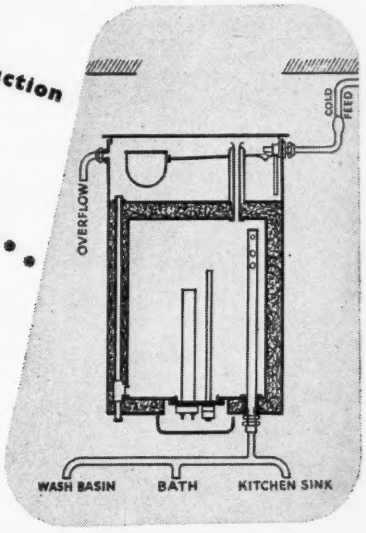




The **Heatrae F.B. Storage type Heater** represents A COMPLETE HOT WATER SYSTEM compacted within minimum dimensions.

It has integral ball-valve cistern, expansion pipe, overflow connection union, etc., for hot water outlet, and is the ideal apparatus for Restaurants, Flats, Offices, etc., where constant supplies of hot water are wanted.

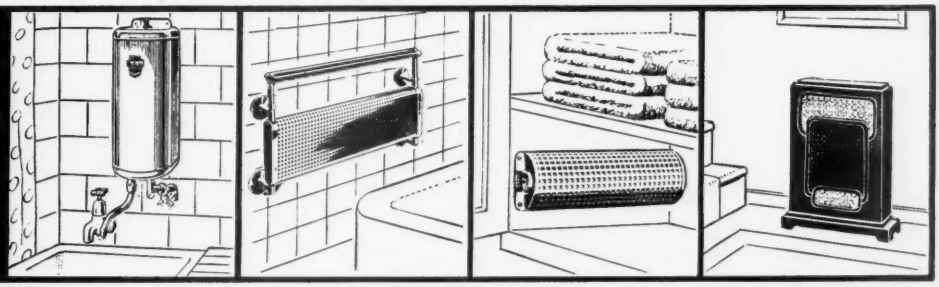
For fuller details write for our Leaflet DEG.



Heatrae

30 years specialised experience in designing and manufacturing of Electric Water Heaters

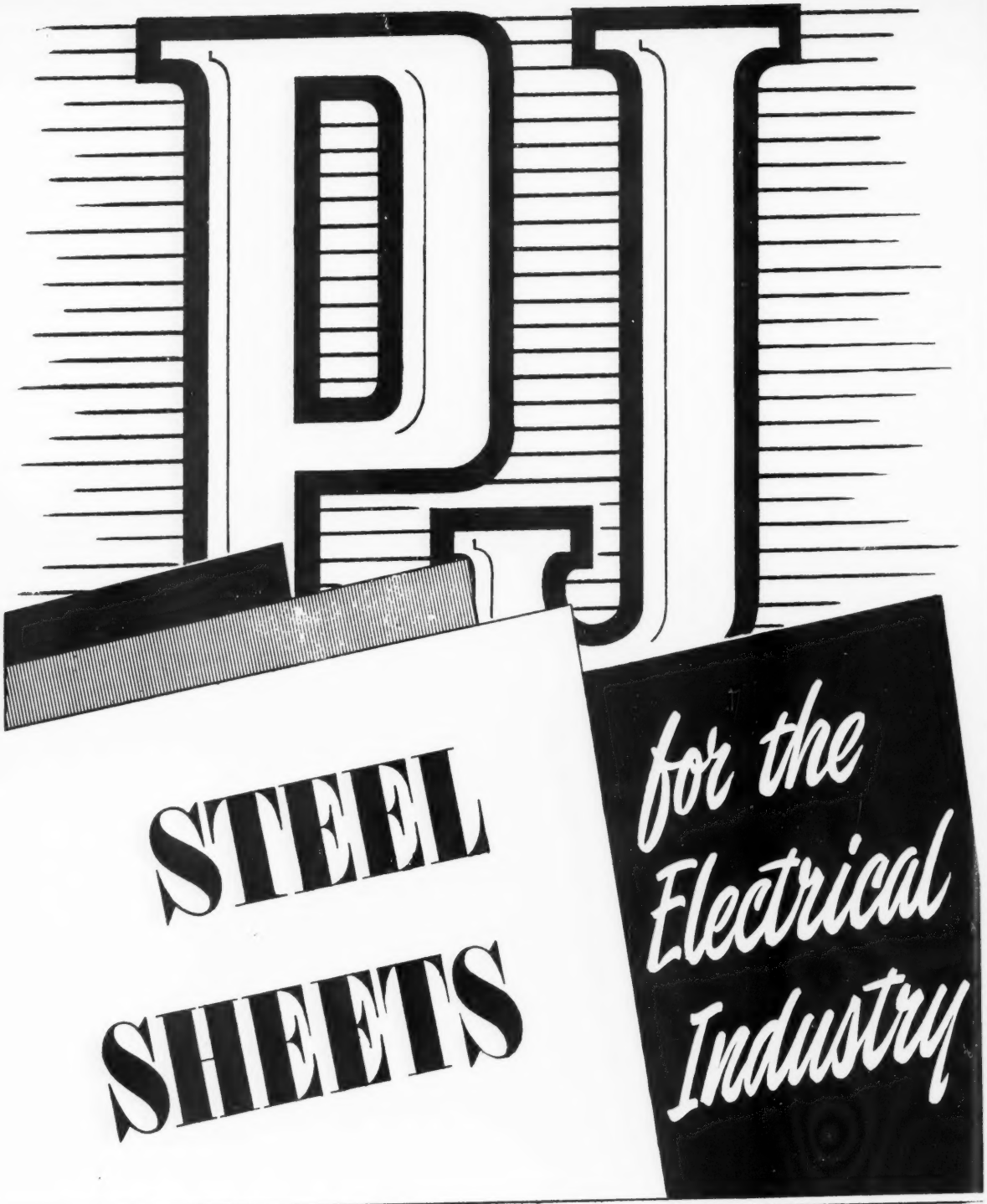
Here are some of the extensive range of our products for industrial and domestic uses...



• D.O.T. ELECTRIC WATER HEATER • AIR WARMER/TOWEL RAIL • AIRING CUPBOARD HEATER • ELECTRIC AIR CONVECTOR

Advertisement issued by HEATRAE LTD · NORWICH · ENGLAND

Manufacturers of: Electric Water Heaters, Oil Heaters, Immersion Heaters, Urns, Towel Rails, Airing Cupboard Heaters, Flameproof Heating Apparatus, Breakfast Cookers, Electric Fires, Food Trolleys, Warming Plates, Air Heaters.



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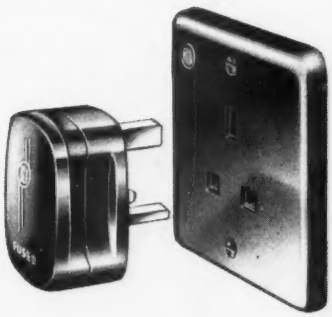

BILL 13 AMP ACCESSORIES TO B.S. 1363

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★ SWITCH SOCKET
★ TWIN SOCKET OUTLET

AVAILABLE FOR SURFACE OR FLUSH MOUNTING
BROWN, CREAM OR IVORY
ALL FITTED WITH CERAMIC BASES ELIMINATING TRACKING
DETAILS ON REQUEST

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MEM SWITCHCRAFT TAKES A NEW TURN

WITH THE NEW **ROTARY FUSED ISOLATOR**

FOR MACHINE TOOLS AND LIKE APPLICATIONS

The surface mounting pattern has conduit knockouts at top and bottom.

Rated at 15 amps. 500 volts, triple pole for use with A.C. motors up to 7½ H.P. max.

It's a tip-top job from start to finish, worthy in every way to be associated with machine tools and similar equipment of the most refined quality. Compact, yet extremely robust, it has all these plus points of design. And remember only M E M resources can offer such quality at prices so competitive.

- The switch is capable of disconnecting a stalled motor of 7½ H.P. taking 6-8 times full load current.
- The moving and fixed contacts are of solid pure silver, thus ensuring long life.
- KANTARK MAJOR rewirable or H.R.C. cartridge fuses are available.
- Interlocked so that cover cannot be removed until switched off.
- Completely safe for fuse renewal. All fuse contacts isolated from supply when cover removed.
- Suitable for Flush or Surface mounting applications.
- Cover fitted with gasket to prevent ingress of dust, moisture, suds, etc.
- Finished in handsome black wrinkle enamel.

Send for Folder No. 346.

MEM — Switch, fuse and motor control gear, electric fires and localised lighting equipment

MIDLAND ELECTRIC MANUFACTURING CO. LTD.
Tyseley, Birmingham 11 *Branches at London and Manchester*

This specialist service in NICKEL AND NICKEL ALLOYS

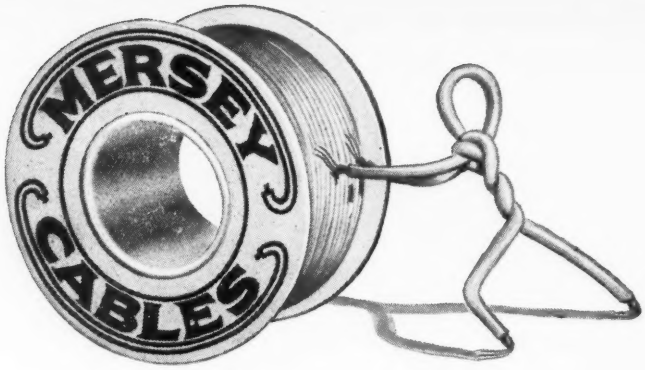
FURNACE ELEMENTS	Nickel alloys for long life at high temperatures; for certain special atmospheric conditions; for furnace constructional work.
DOMESTIC APPLIANCES	" Nichrome " V for long life at temperatures up to 1,150°C; " Nichrome " for temperatures up to 950°C; other alloys for less exacting conditions.
THERMO-COUPLES	"T1/T2" alloys (nickel-chromium and nickel-aluminium) for temperatures up to 1,100°C, are identical with the best-known wires formerly imported. Also Special " Advance " (nickel-copper) for use with copper or iron.
RADIO and TV FIELD	Cathode nickel, pure nickel and nickel-manganese, for sleeves, anodes, grids, filaments, supports, glass metal seals, etc.
LAMP INDUSTRY	Nickel-manganese for supports, grids, and lead wires; special alloys for a variety of efficient joints between metal and glass.
SPARK PLUGS	Alloys of the correct physical properties and temper to meet manufacturing requirements in centre and side electrodes; and such as special strip for stamping out multi-point discs for aircraft plugs.
FINE WIRES	Very fine wires from .002 in. downwards in various alloys, such as 80/20 Nickel Chrome, Pure Nickel, etc., for specialized applications.

BRITISH DRIVER-HARRIS CO. LTD

MANCHESTER 15

The greatest name in electrical resistance

"NICHROME"
REGISTERED TRADE MARK



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RUBBER AND THERMOPLASTIC INSULATED WIRES, CABLES AND FLEXIBLES

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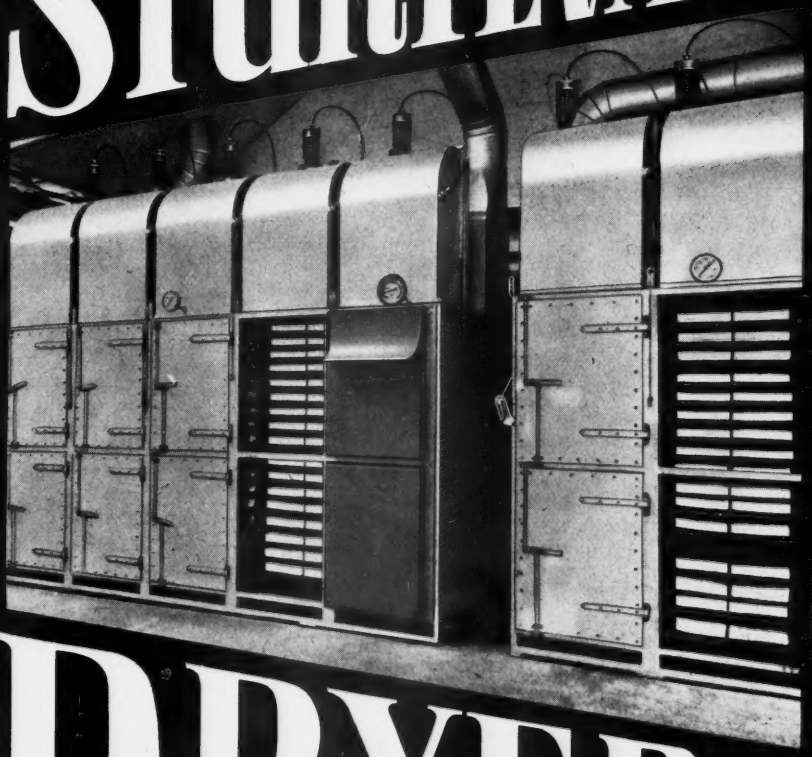
STURTEVANT



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for all problems involving mechanical
and controlled drying

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FIRE BARS & TUBULARS ★

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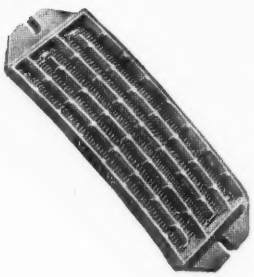

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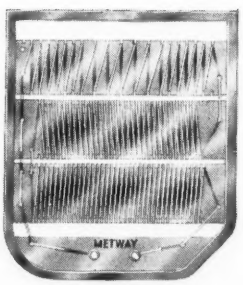

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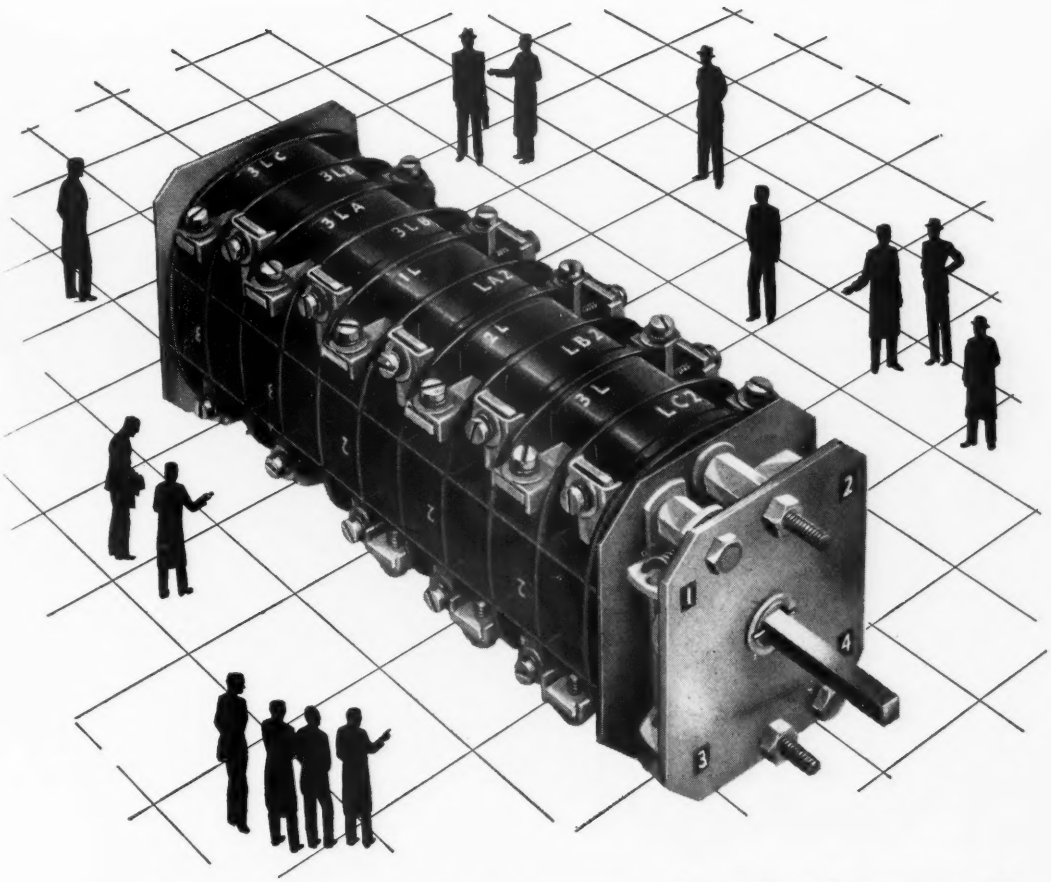
METWAY ELECTRICAL INDUSTRIES LTD.

KING STREET, BRIGHTON 1, SUSSEX

Telephone: Brighton 28366 (7 lines) *Telegrams: Metway, Brighton*



....the Brookhirst 303 Switch has set people talking.....

No wonder ! This ingenious design rotary switch provides the solution to 'on-load' multi-circuit switching problems of long standing. Nothing is left to chance as witness the self-cleaning, 'silver to silver' contacts, the high-quality mouldings with generous clearances and creepages, and the easy-to-wire terminals. Moreover, though very compact, the type 303 switch is robust down to the smallest detail. There are two sizes with *continuous* current carrying capacities of 30 amps (size 1) and 60 amps (size 2), 550 volts A.C. and D.C. The making and breaking capacities are exceptionally high for the sizes of switch and the contacts will stand up to arduous duties involved in machine tool control. The switch has four positions controlled by a cam-operated spring-loaded mechanism. Typical applications are forward and reverse control and control of two-, three- or four-speed change-pole motors. With its extreme adaptability, however, the type 303 switch can cater for almost any switching sequence and load conditions. Arrangements from two to five poles are available ex-stock. **Let us send you Specification Leaflet 2017c.**

BROOKHIRST SWITCHGEAR LIMITED, CHESTER

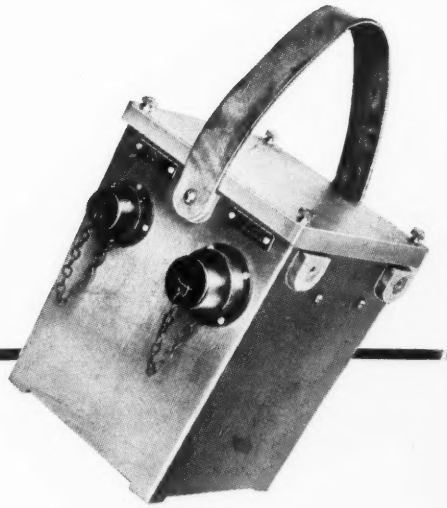
BRANCH OFFICES: LONDON, MANCHESTER, BIRMINGHAM, LEEDS, NEWCASTLE BRISTOL, CARDIFF, NOTTINGHAM, GLASGOW

Above: TEAK CASE PORTABLE TRANSFORMER

Right: PORTABLE TRANSFORMER SHOWN IN DIE CAST ALUMINIUM CASE

NELSON

portable transformers



THE NELSON ENGINEERING CO LTD

Below: METAL CLAD, AIR-COOLED TYPE, WITH REYROLLE PLUGS

Nelson air-cooled portable transformers are designed for varying applications where a low voltage supply is required for the operation of han lamps and portable tools. The normal industria unit is enclosed in a mild sheet steel case, whilst a similar model has a teak case, dovetailed on th corners with screws for attaching the lid and bas Units can also be supplied with die cast aluminium casings for use where there is risk of explosion should the transformer be dropped on stone, concrete or steel and generate a spark.

THE NELSON ENGINEERING CO LTD NELSON LANCS PHONE: NELSON 1545-6 GRAMS: NELSON 1545

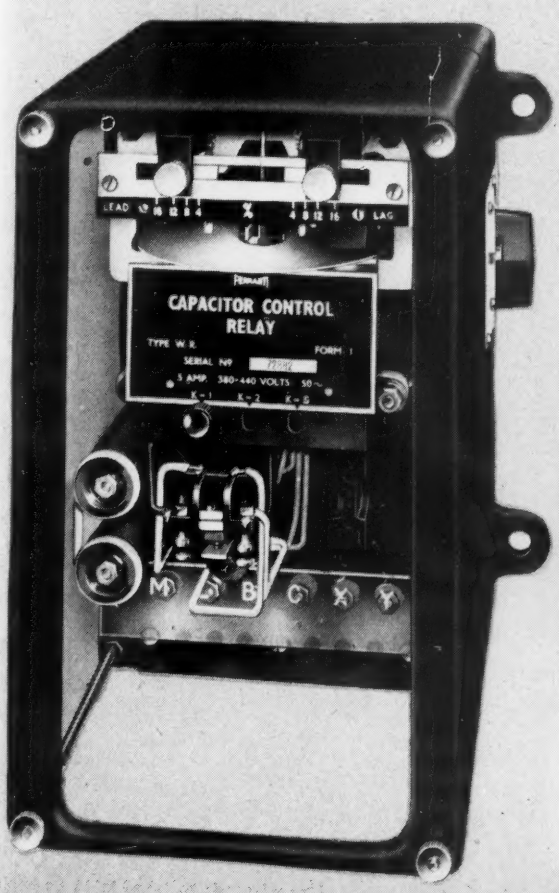
P4858/A

FERRANTI

CAPACITOR CONTROL RELAY

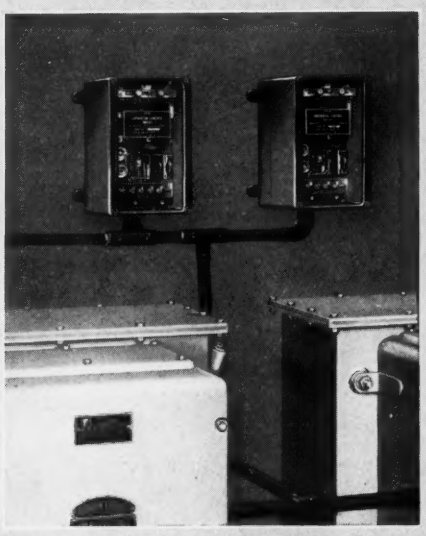
(TYPE WR)

FOR SINGLE STAGE CONTROL



This relay provides *automatic power factor correction* when used with suitable capacitors.

- Independently adjustable "lead" and "lag" settings over a wide range.
- Self-contained auxiliary element with substantial contacts to operate the heavy duty capacitor contactor.
- Selector switch to give automatic or manual control as required.



Installation of capacitors and contactors controlled by Type WR Relays.

FERRANTI

FERRANTI LTD · MOSTON · MANCHESTER 10

London Office: KERN HOUSE, 36 KINGSWAY, W.C.2.

ELECTRIC CLOCKS · *ALWAYS RIGHT ON TIME*

F.I.137

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- *Automatic oven control and Simmerstat*
- *Very large oven, with removable lining*
- *Large hotcupboard. Utensil drawer 24/- extra*
- *Exclusive full-size inner glass door*
- *Finished in white or cream vitreous enamel*

You can't beat a "Belling"

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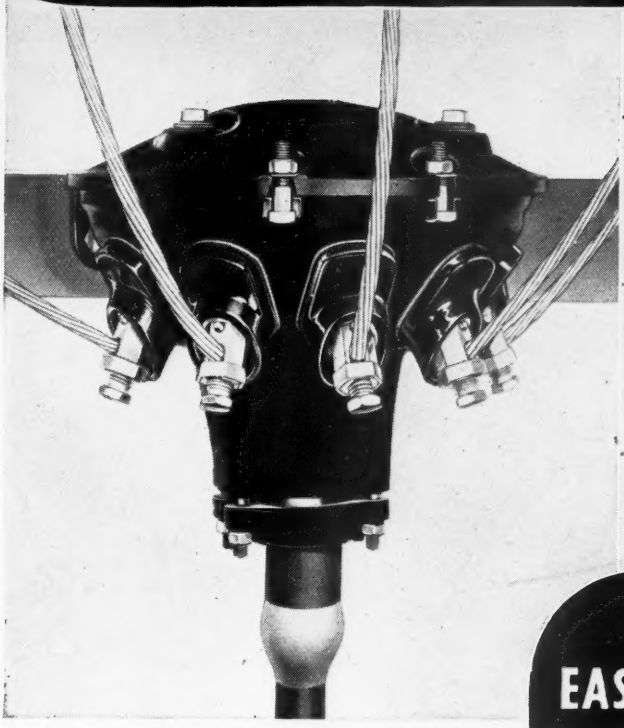
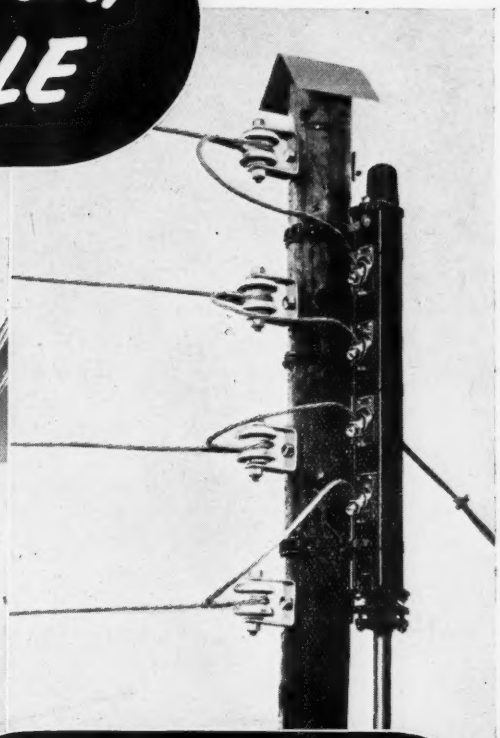
JOINTING IS QUICK, SIMPLE, RELIABLE



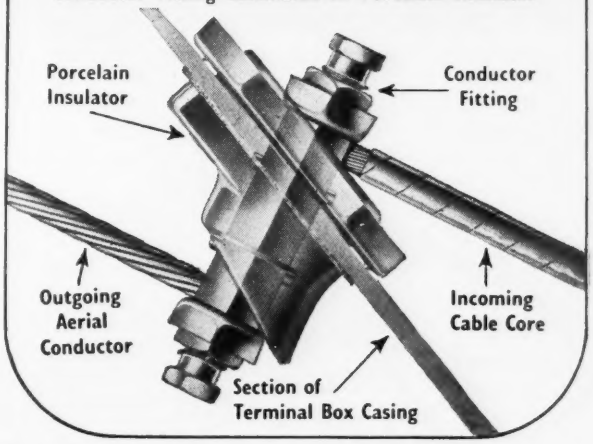


HENLEY low tension terminal boxes for pole mounting include: TIER TYPE for line conductors arranged in vertical formation, and INVERTED TYPE for conductors arranged in horizontal or similar formation.

Please write for Catalogue 50, giving full details of the complete range.

Note this EASY JOINTING FEATURE

Ghosted illustration showing tinned brass Conductor Fitting assembled in Porcelain Insulator



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SUPPLY LINES FOR POWER

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OIL-FILLED CABLES

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MANUFACTURERS OF EVERY KIND OF ELECTRIC CABLE

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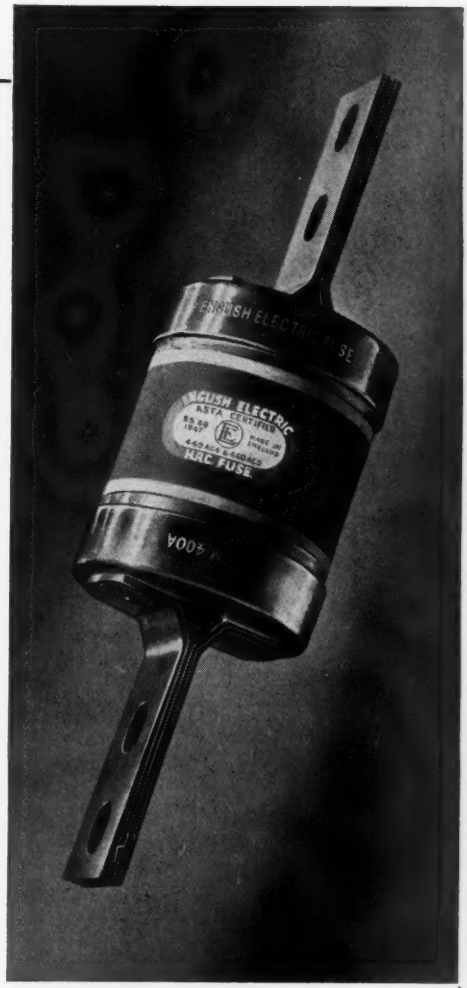
ASTA certified

The Association of Short Circuit Testing Authorities (ASTA) issues Certificates of Rating for fuses giving satisfactory performance when tested in accordance with the appropriate clauses of British Standard 88.

The complete range of 'ENGLISH ELECTRIC' Type 'T' High Rupturing Capacity Non-Deteriorating Cartridge Fuse Links has been A S T A certified for Category of Duty 440AC4 to the 1939 edition of B.S.88 (the highest category at that time) and for Categories of Duty 440AC4 and 440AC5 representing 25MVA and 35MVA respectively to the 1947 edition of B.S.88.

RATING AMPS.	LIST NOS.	ASTA CERTIFICATE NUMBERS		
		B.S.88: 1939	B.S.88: 1947	
		440 AC 4	440 AC 4	440 AC 5
30	T1A30	617	1016	2074
60	T1S60	616	903	2022
100	TC100	615	932	2021
200	TF200	251	933	2033
300	TKF300	252	934	2032
400	TM400	629	935	2031
500	TT500	354	936	2025
800	TLT800	353	2098	2026



'ENGLISH ELECTRIC'

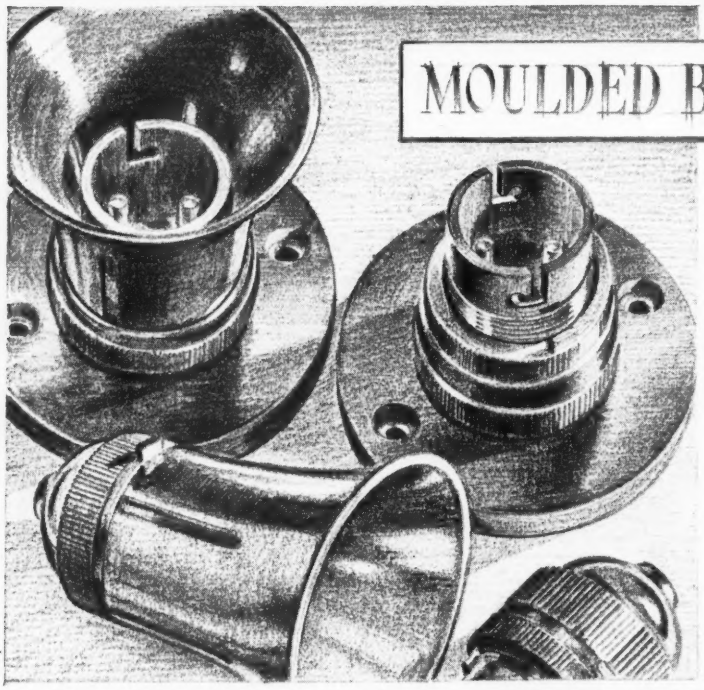
h.r.c. fuse links

See also our Industrial Motors advertisement in this issue

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Fusegear Works, East Lancashire Road, Liverpool, 10

F.7 WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON



MOULDED BAYONET HOLDERS

by Sperryn TRADE MARK

A complete range of Batten, C.T.S., Skirted, Conduit, Switch and Flexible lampholders are available complying with B.S.52

for Efficient Electrical Accessories of Quality

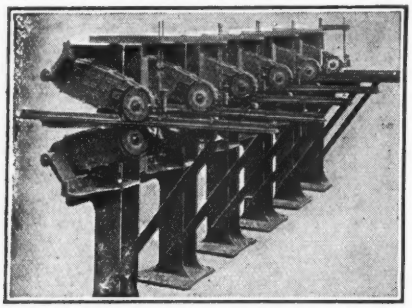
"Specify Sperryn"

SPERRYN & CO. LTD., MOORSOM ST., BIRMINGHAM 6

London Office: 23 Great Suffolk Street, S.E.1

The WESTMINSTER ENG. Co. Ltd.
VICTORIA ROAD, LONDON, N.W.10

London Telephone: Elgar 7372 (2 lines)



For removing the scale from 2 surfaces on one edge of plate simultaneously, preparatory to welding.

A batch of single-ended Pedestal Type

PATENT **SCALING MACHINES**

MICA

Processed for all uses
COMMUTATOR SEGMENTS
HEATING ELEMENTS
SWITCHGEAR, ETC.

VARNISHED COTTON
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In various colours — Deliveries from stock

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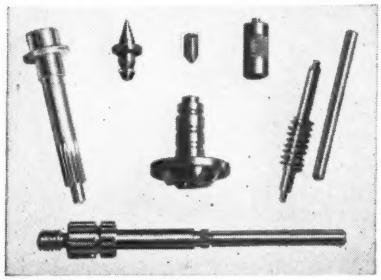

Pinions, pivots shafts and any other turned parts in any metal.

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an additional economy when using GRID SUSPENSION the economical wiring system

the ENsphere lighting fitting

The ENsphere cable connection is integral with the lighting fitting (an additional saving) and as with all Grid Suspension installations, no wires are cut in the making off. All work can be done at ground level, and the completed span is then lifted into position and tensioned.

Of new design, the ENsphere lighting fitting has a light output ratio higher than the corresponding ordinary vitreous enamelled steel reflector. Full technical data is available on request.

ENsphere reflectors are made in opal "Perspex"* and may be used open or with an inverted cover. The range of ENsphere fittings now includes 100/150, 200, 300 and 500 watt sizes for tungsten lamps; others will follow shortly.

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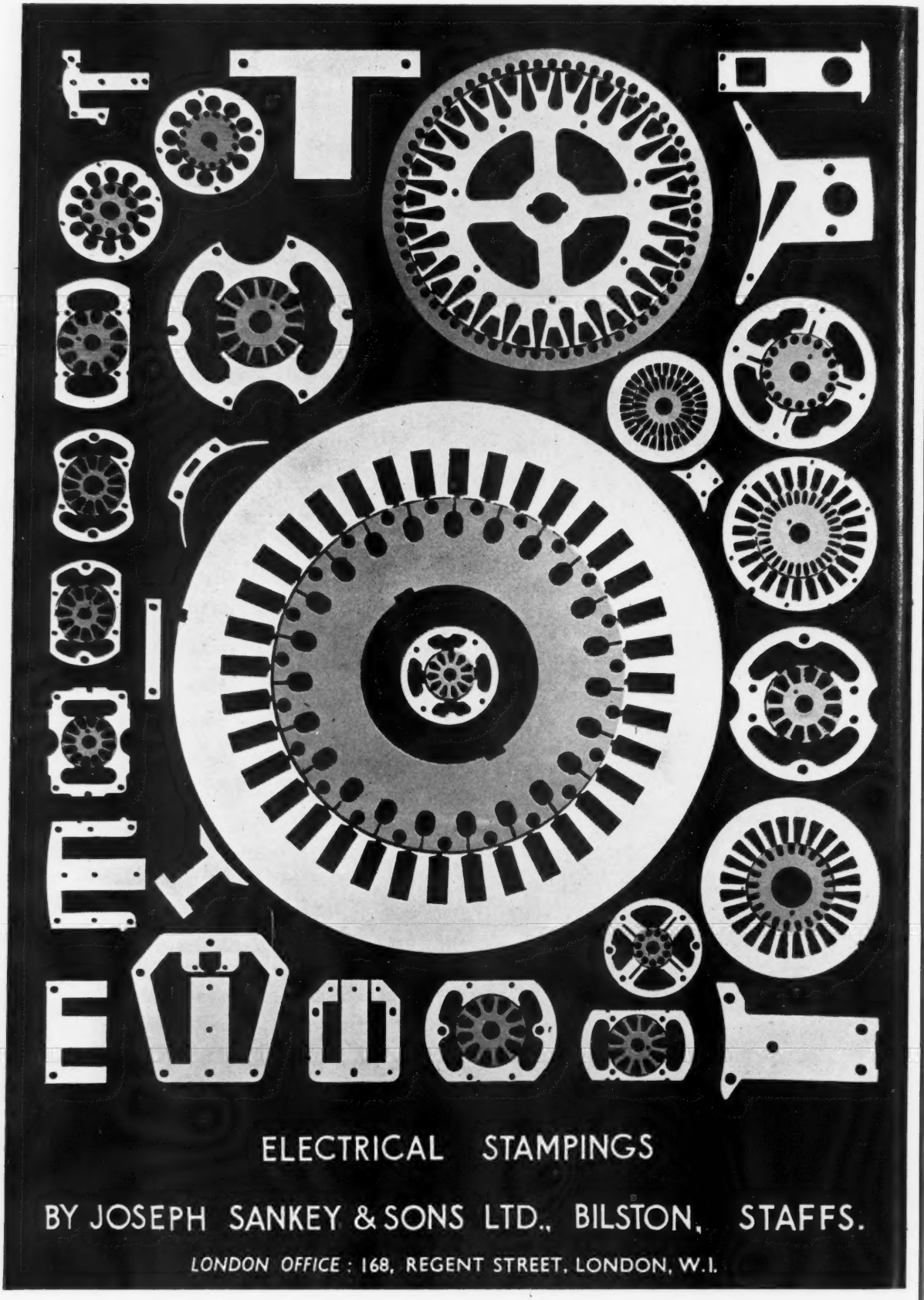
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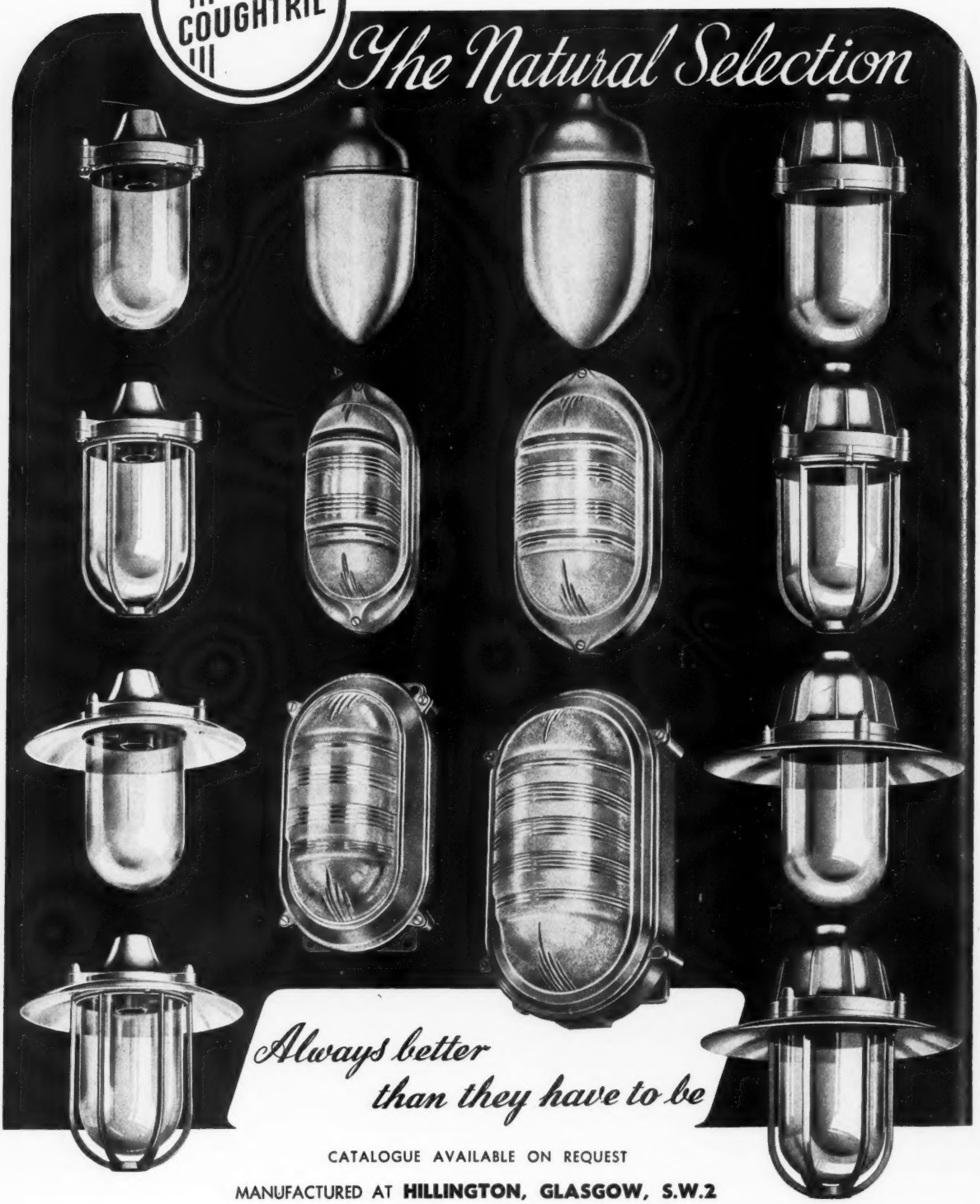

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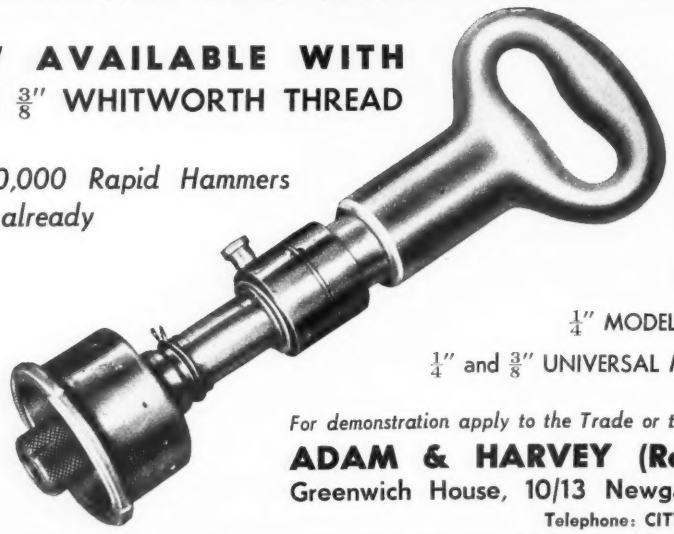

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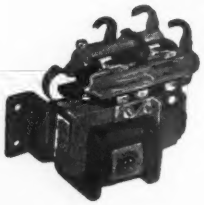

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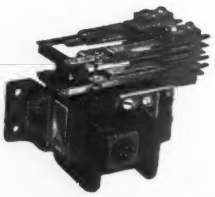

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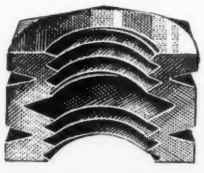

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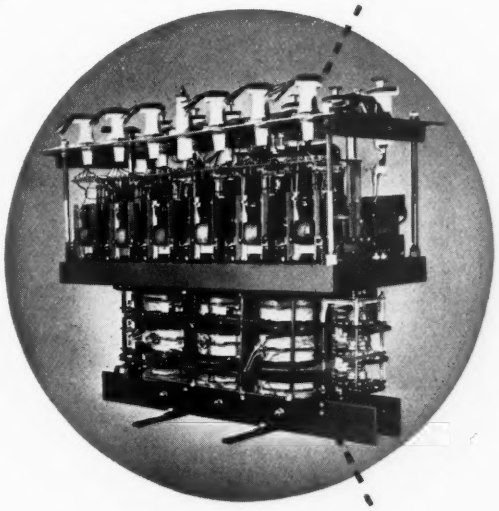

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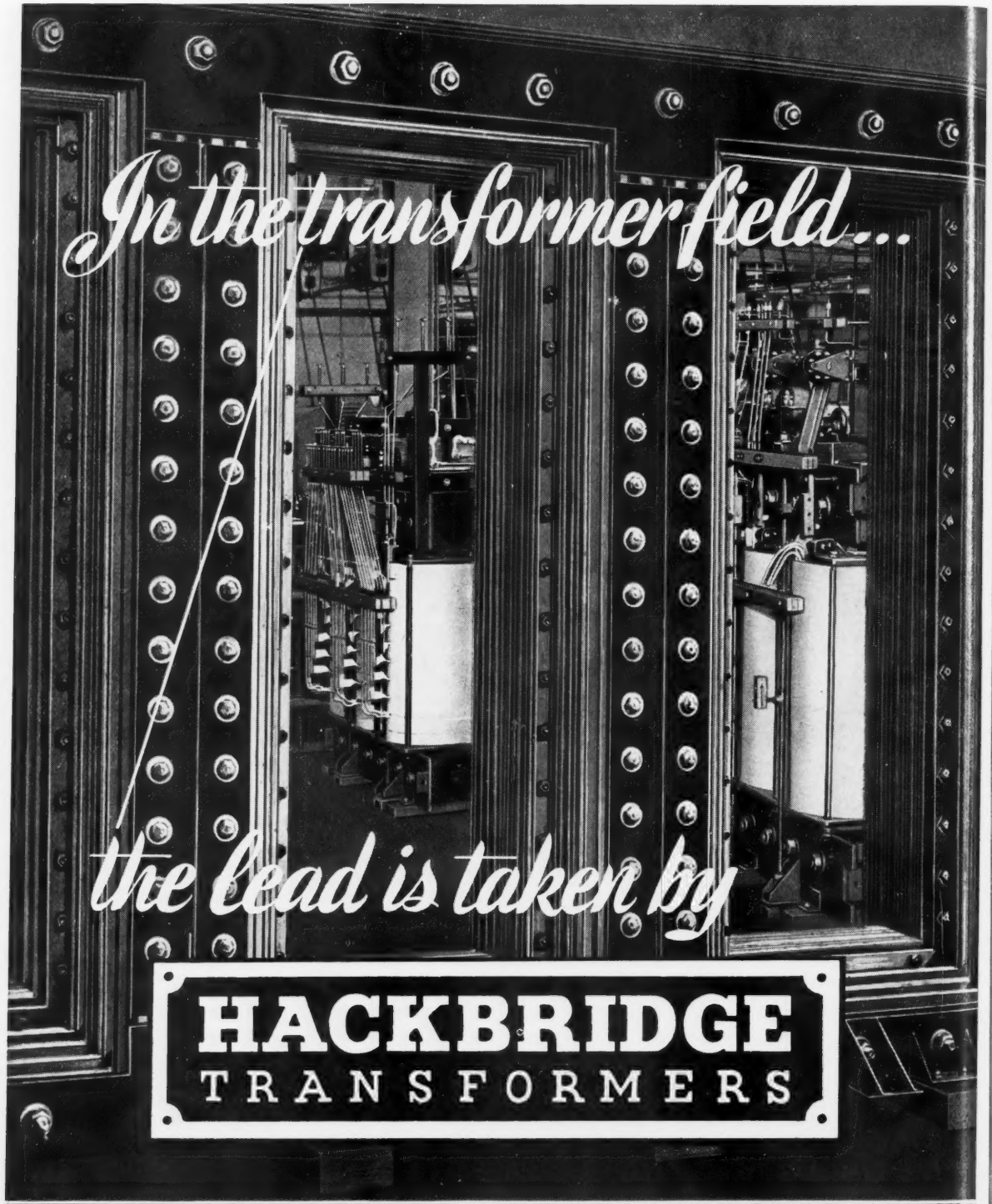

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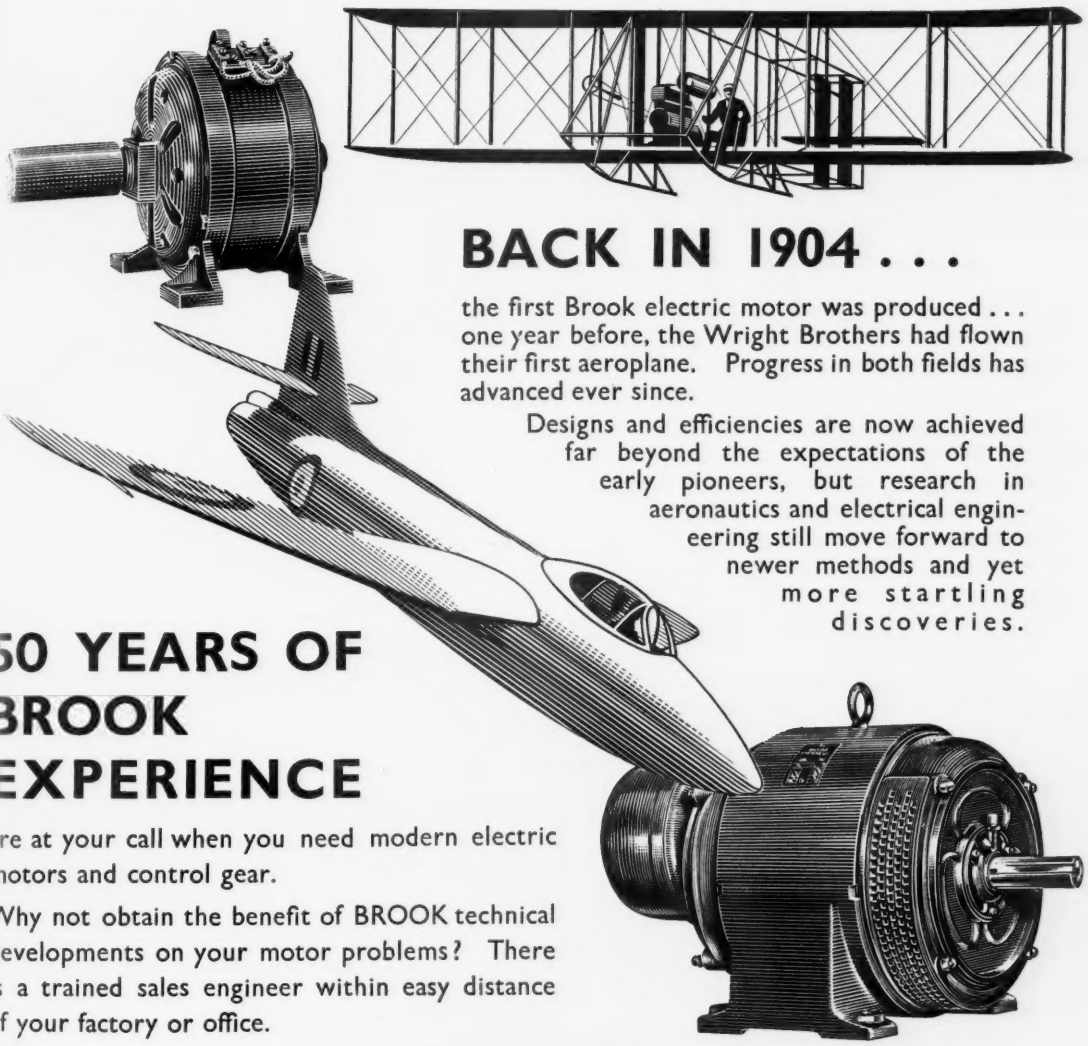

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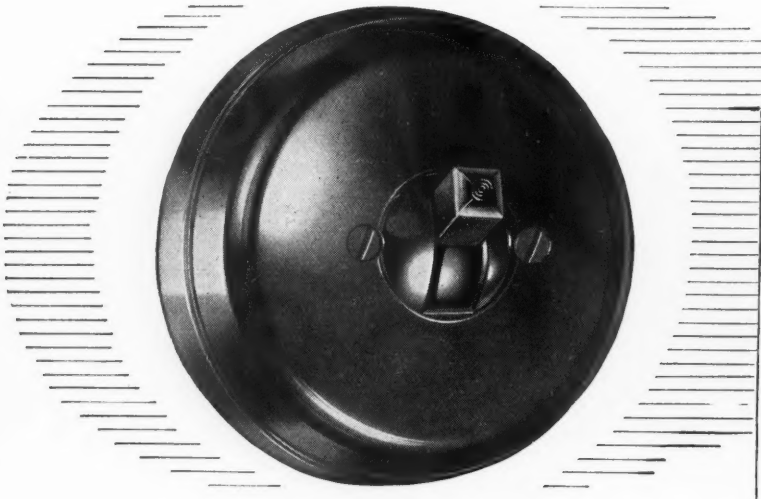

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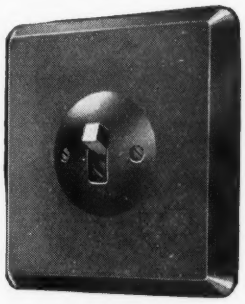

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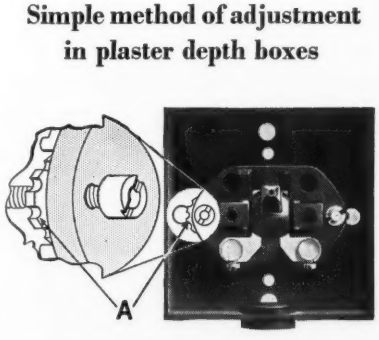

The adjusting device, as illustrated above, supplied with plaster depth boxes provides a simple method of switch depth adjustment whilst the switch is in position. The adjuster **A** can be rotated until the switch is set at the required height.
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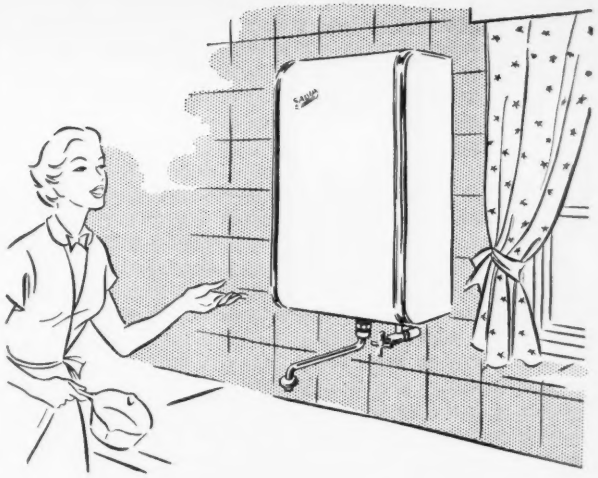

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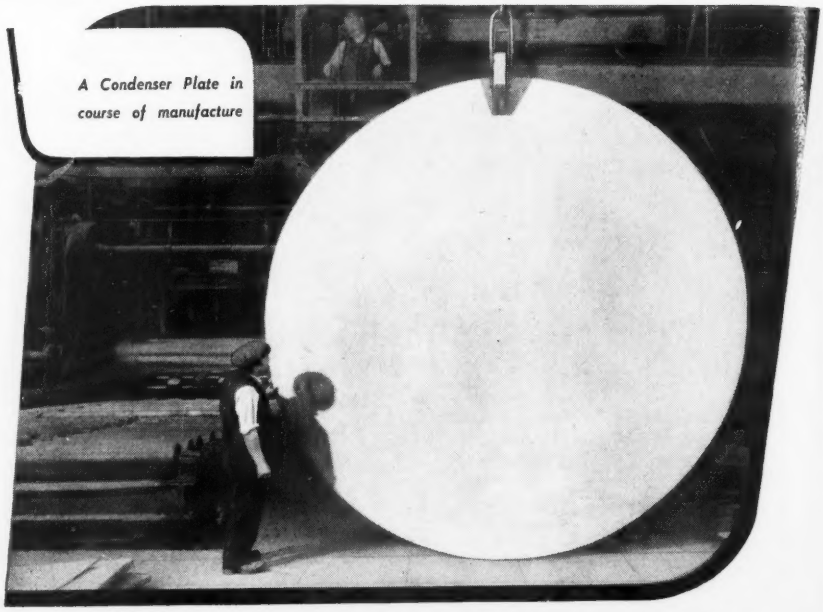

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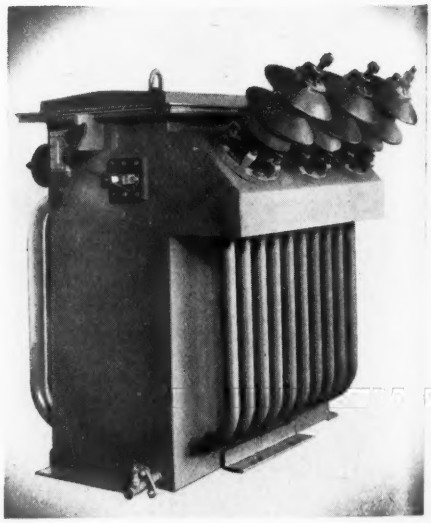

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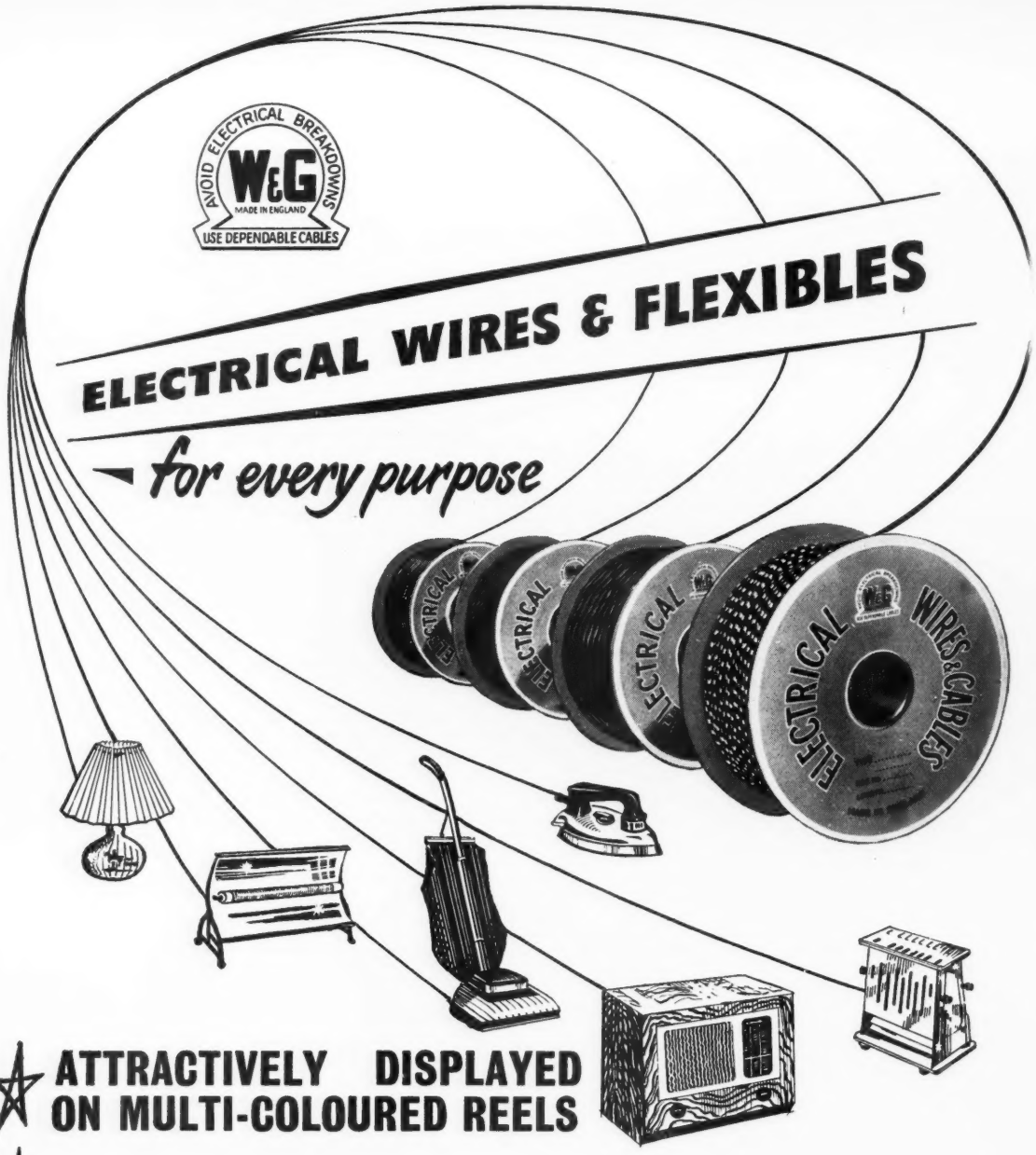

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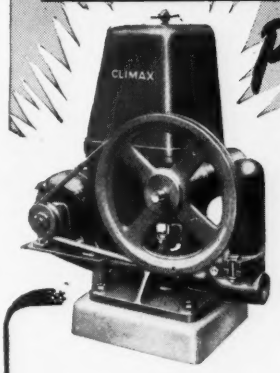

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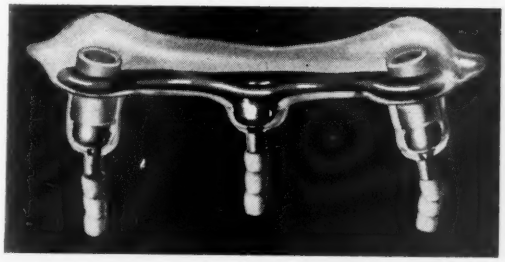

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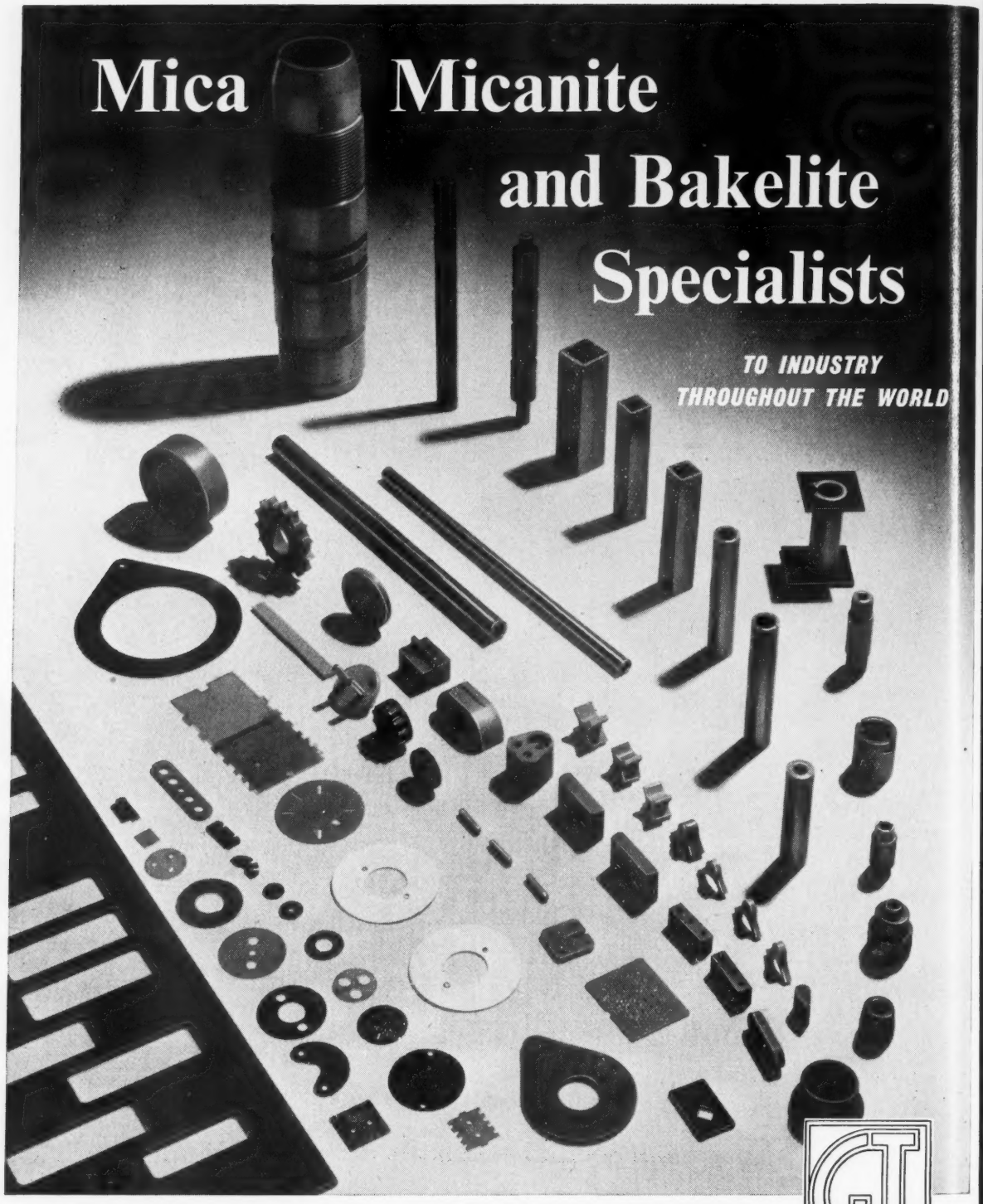

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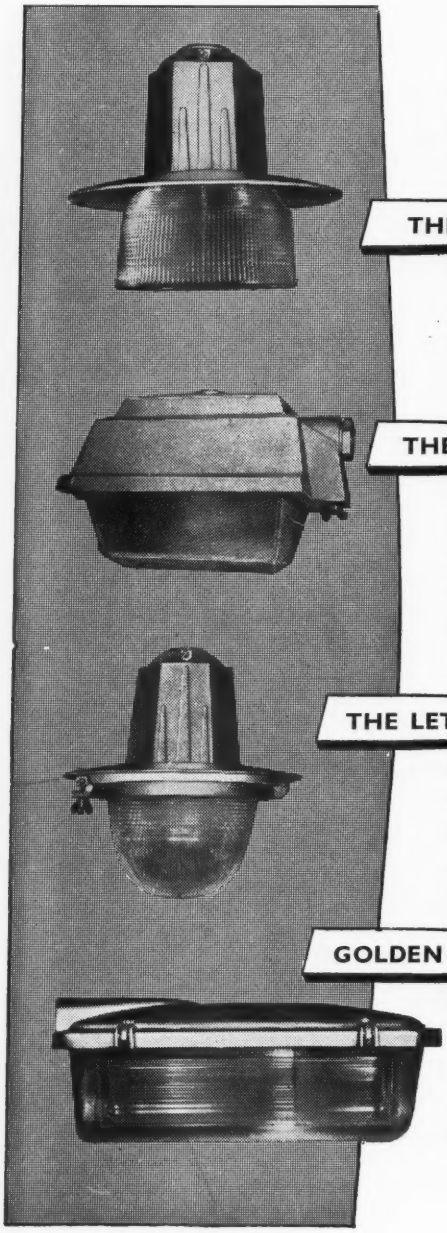

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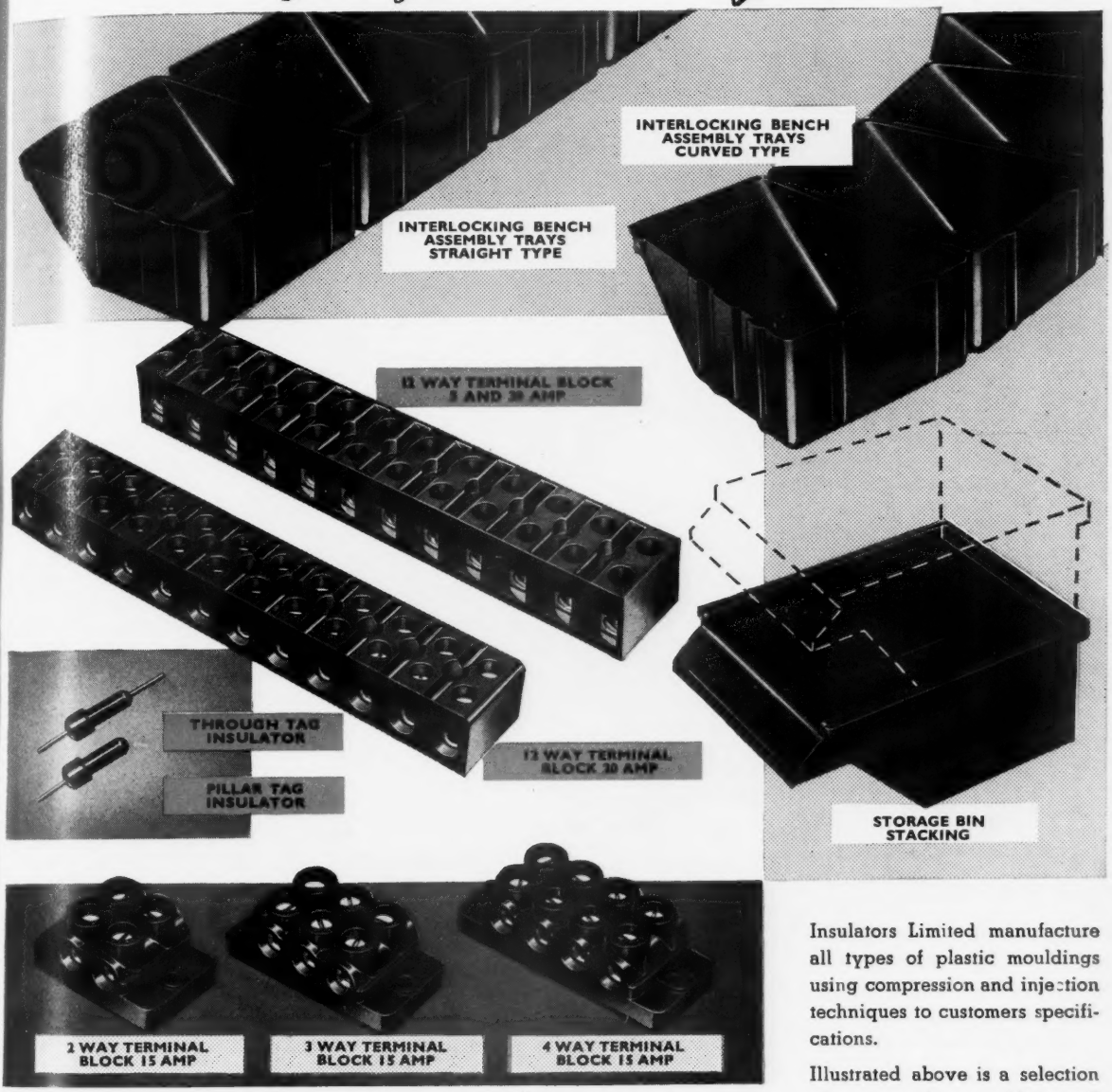
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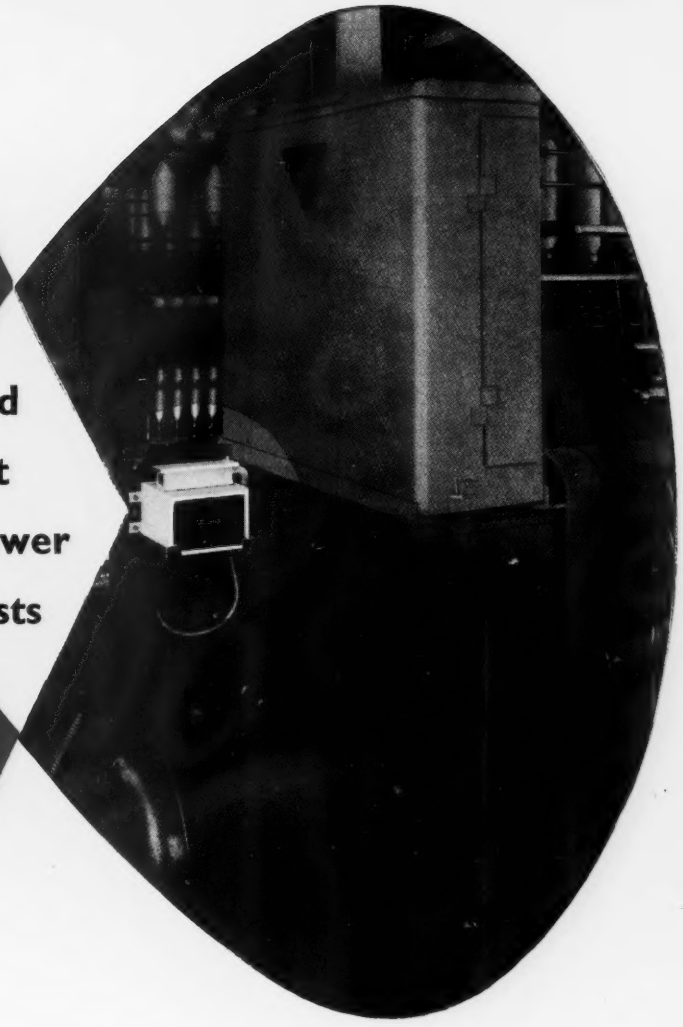

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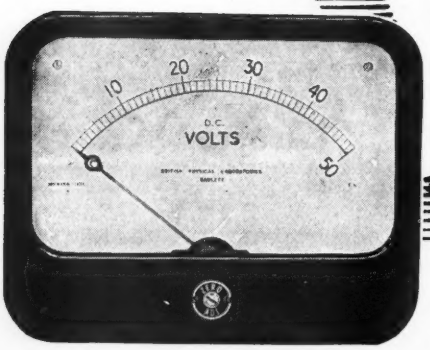

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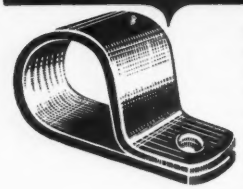

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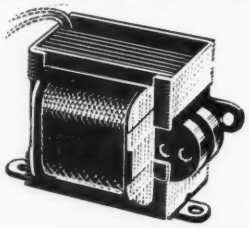

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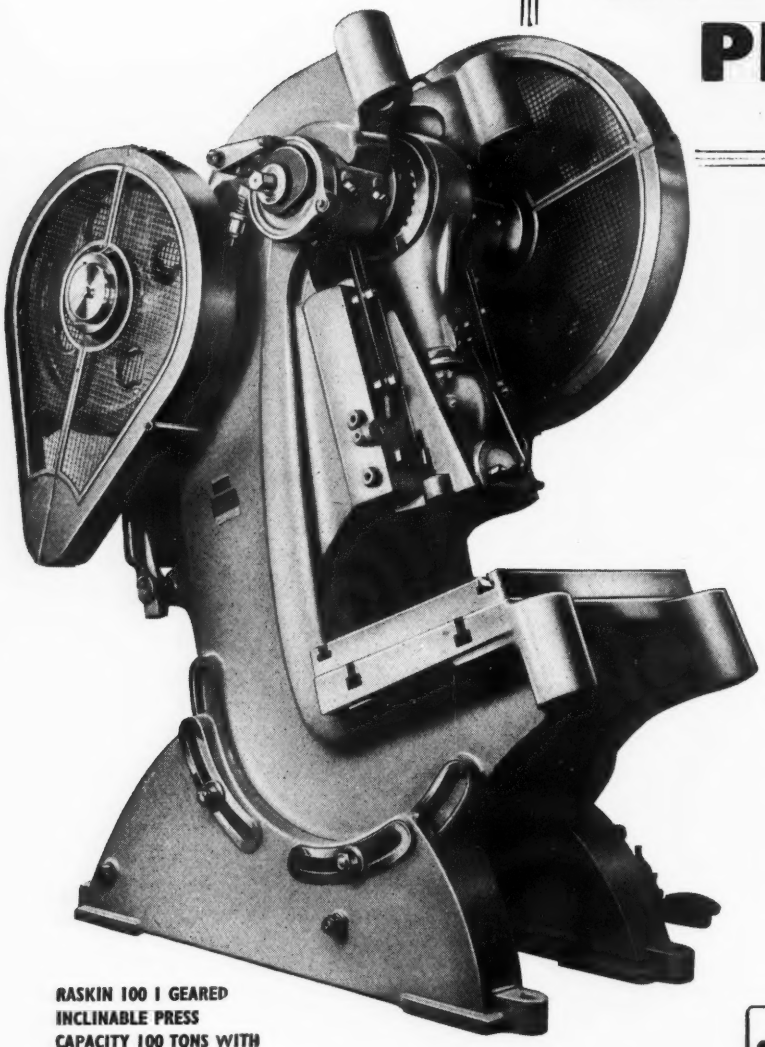

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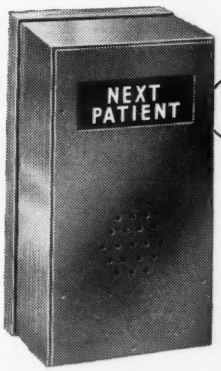

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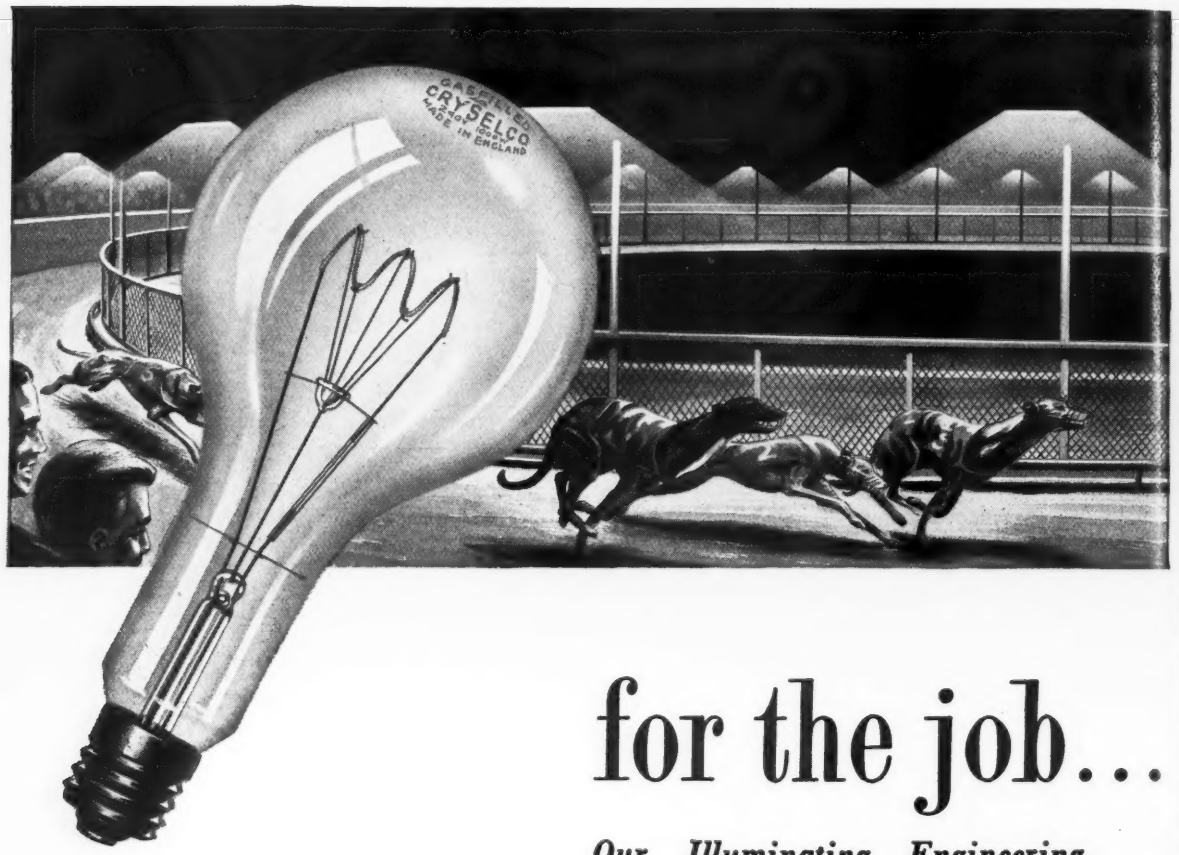

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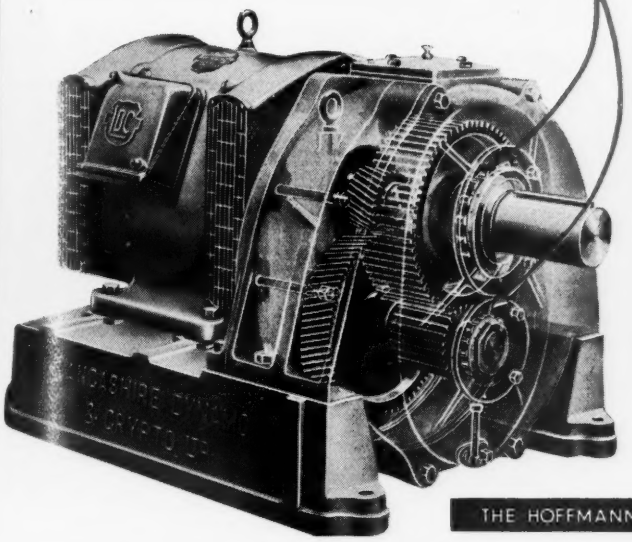

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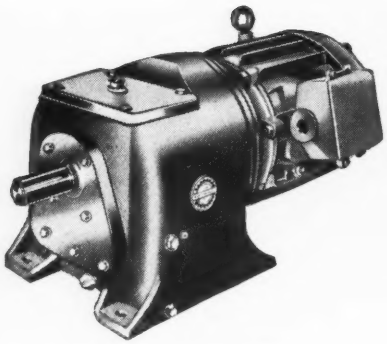

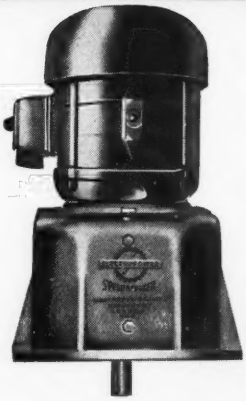

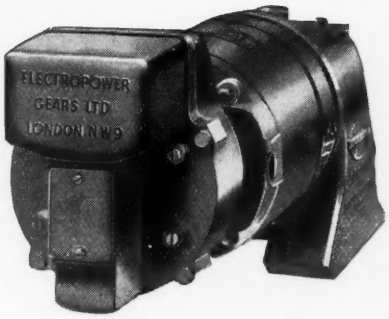

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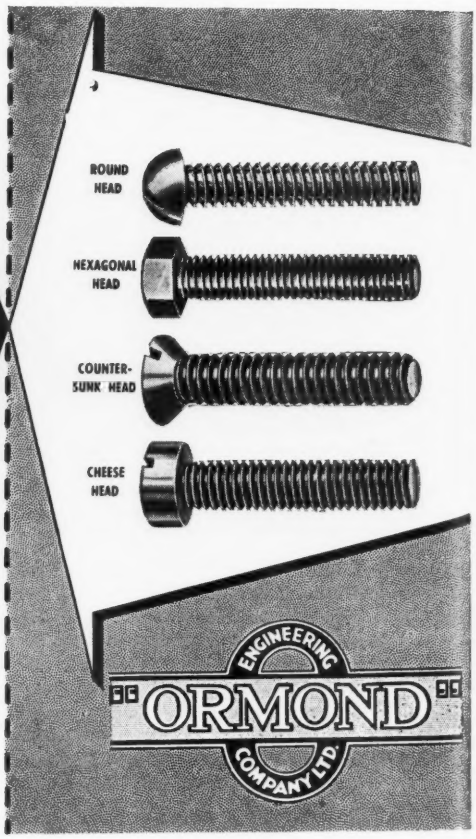

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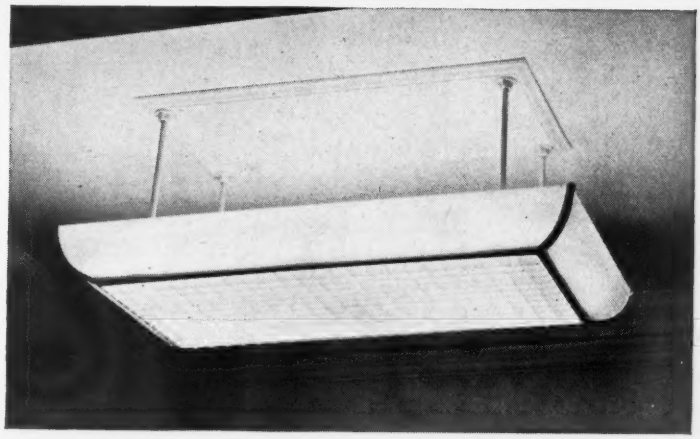

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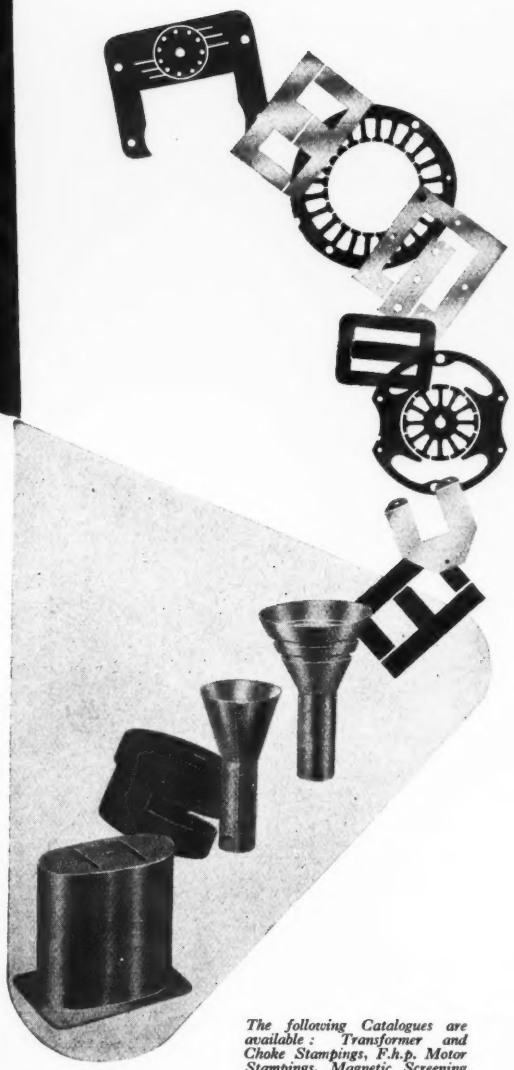

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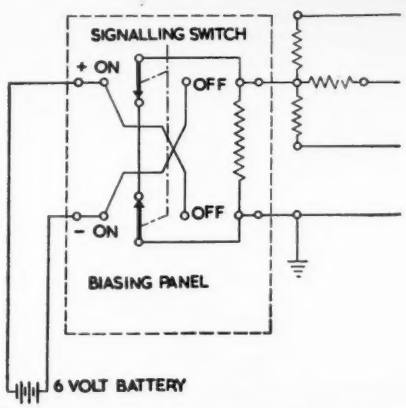

This diagram shows how simple it is. The only additional equipment needed is a single robust relay on each lamp standard.

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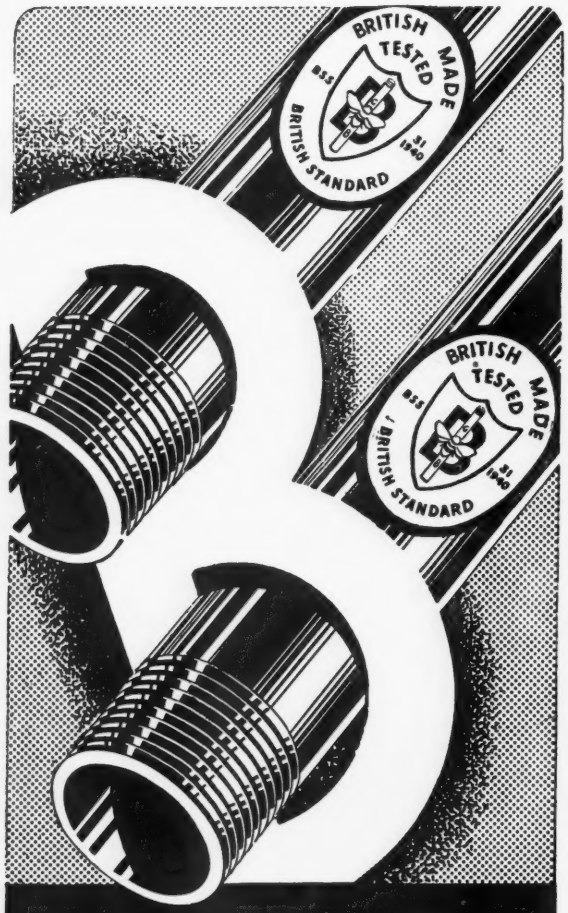

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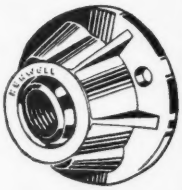

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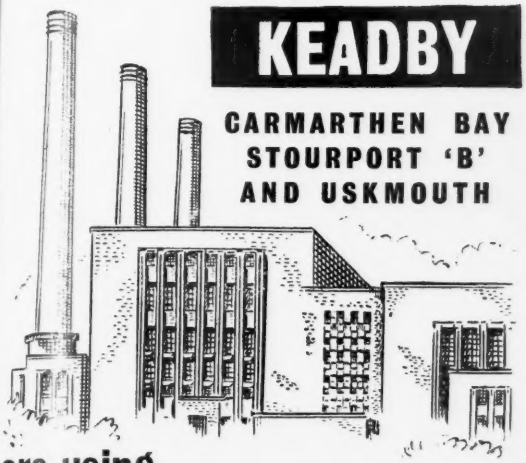

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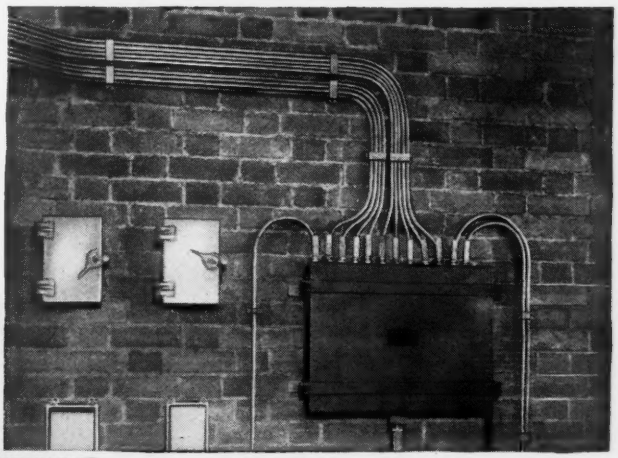

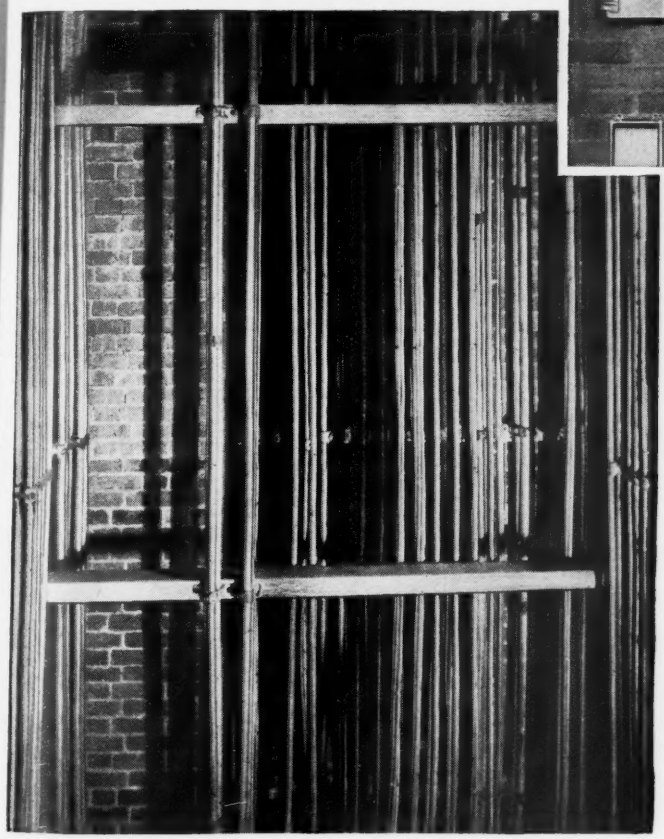

Above: Neatly installed formations of aluminium sheathed wiring cables terminating in a marshalling box.

Left: A main cable trunk at Keadby comprising 150 h.v. and l.v. cables, all but a few being aluminium sheathed.

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Photographs taken at Keadby Power Station.
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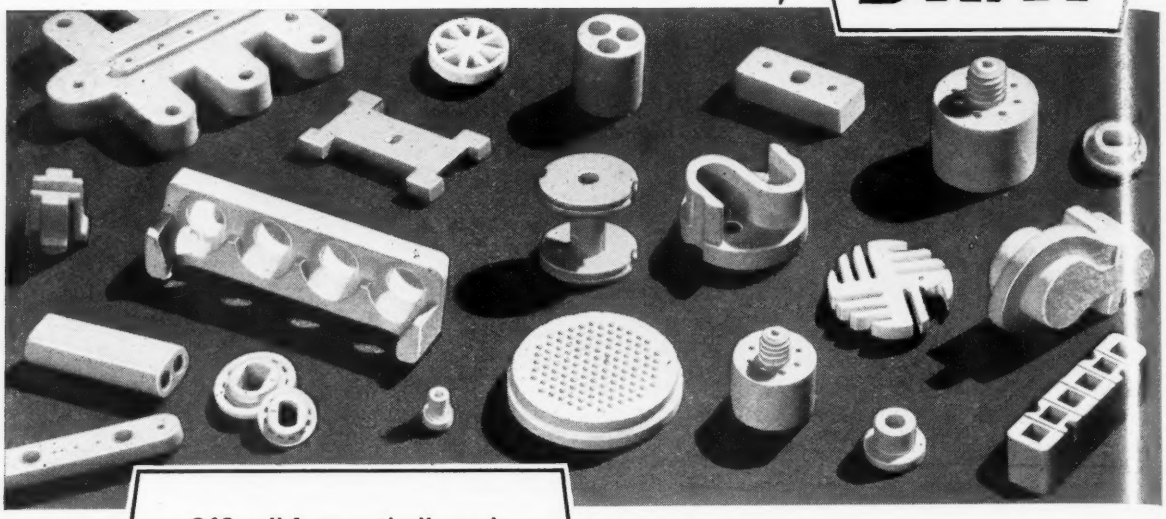

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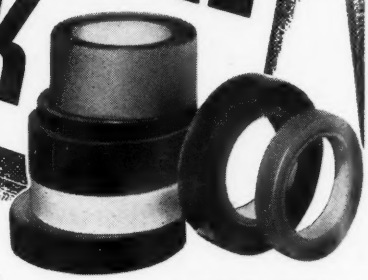

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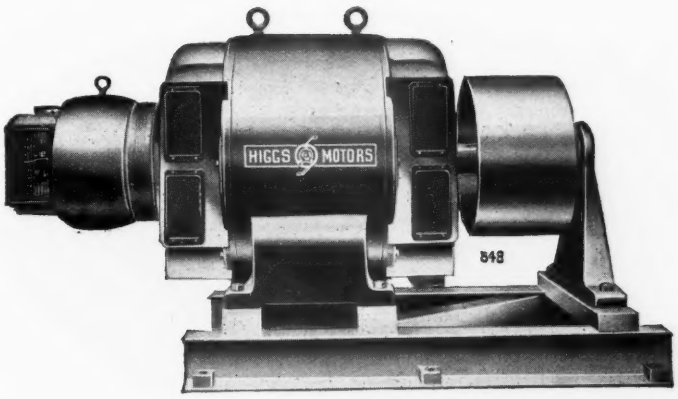

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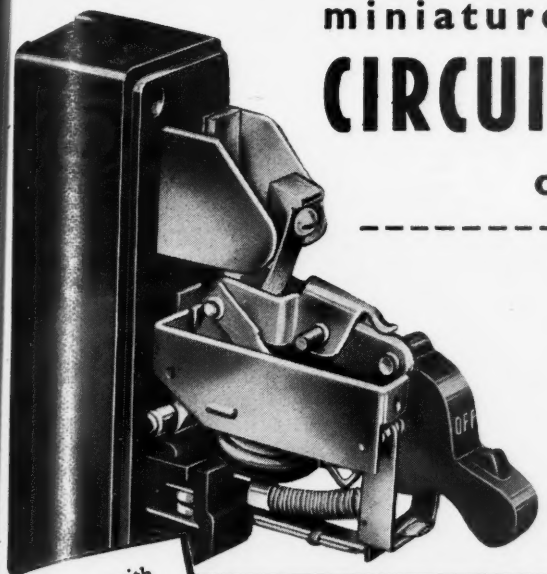

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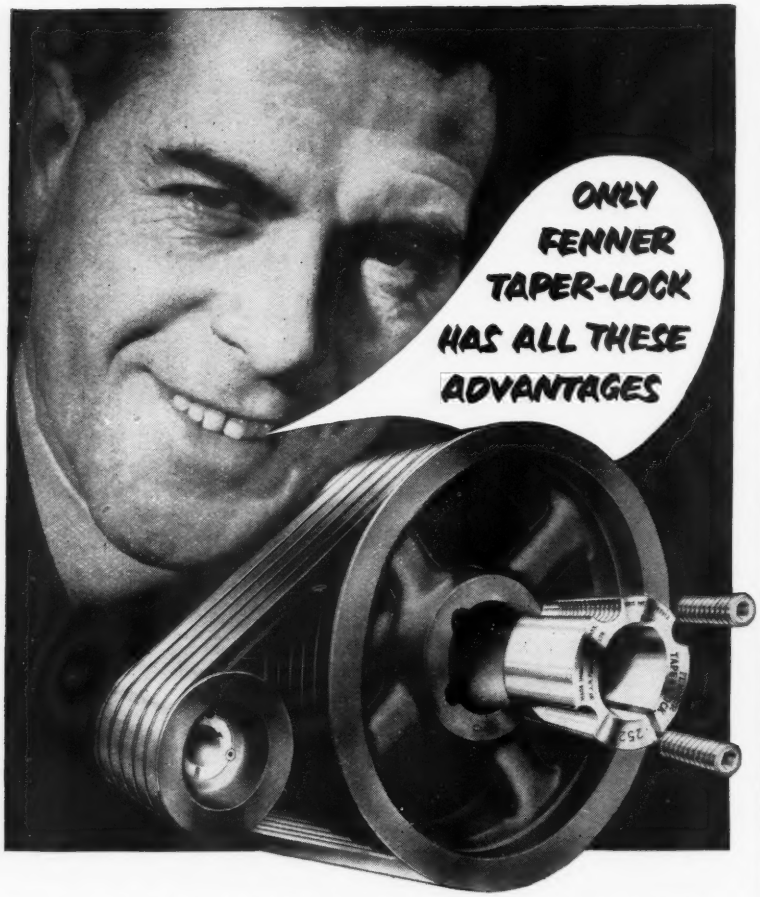

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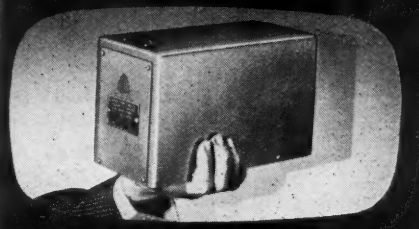

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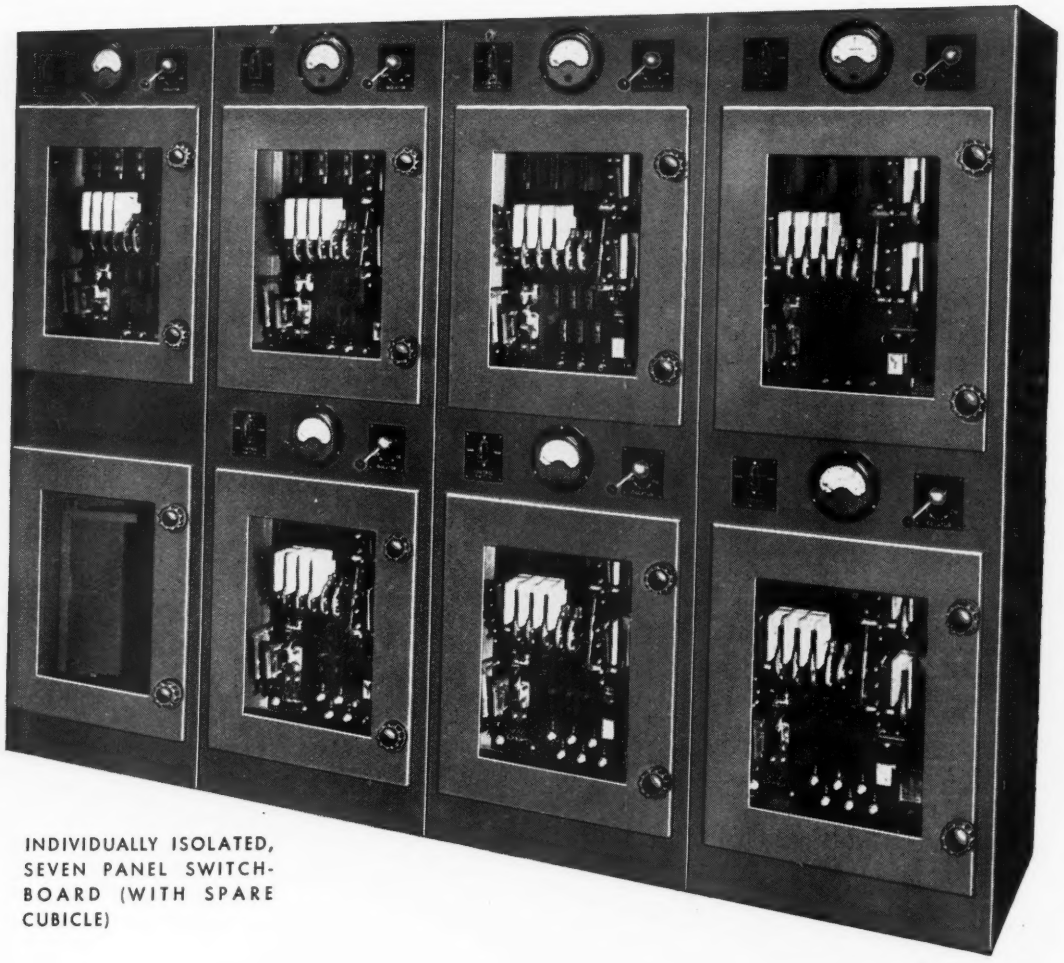

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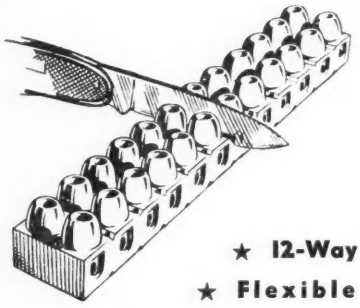

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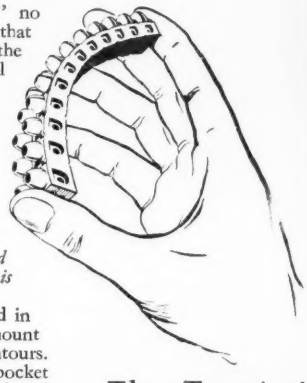

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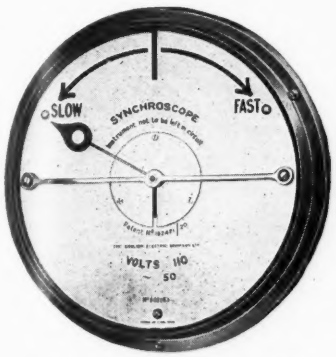

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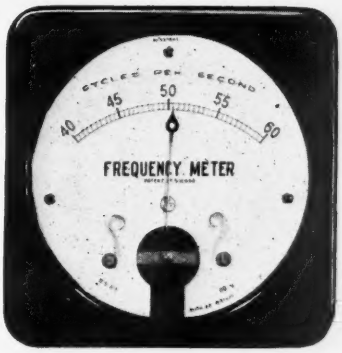

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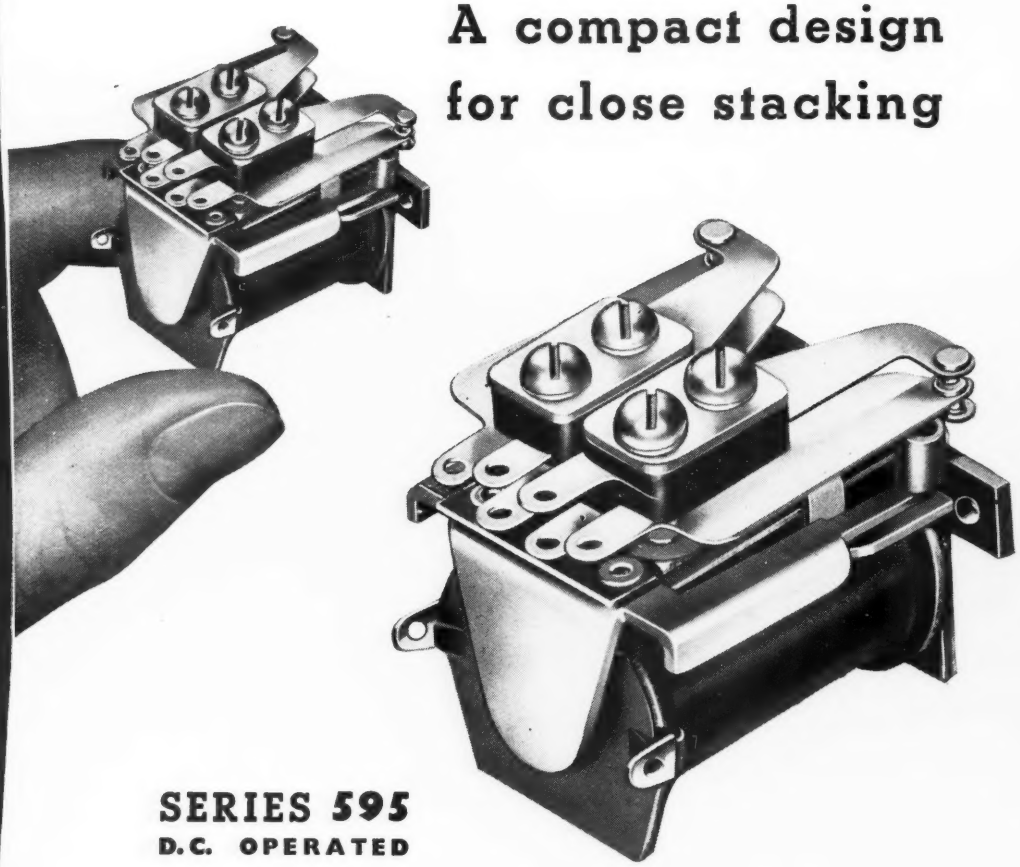

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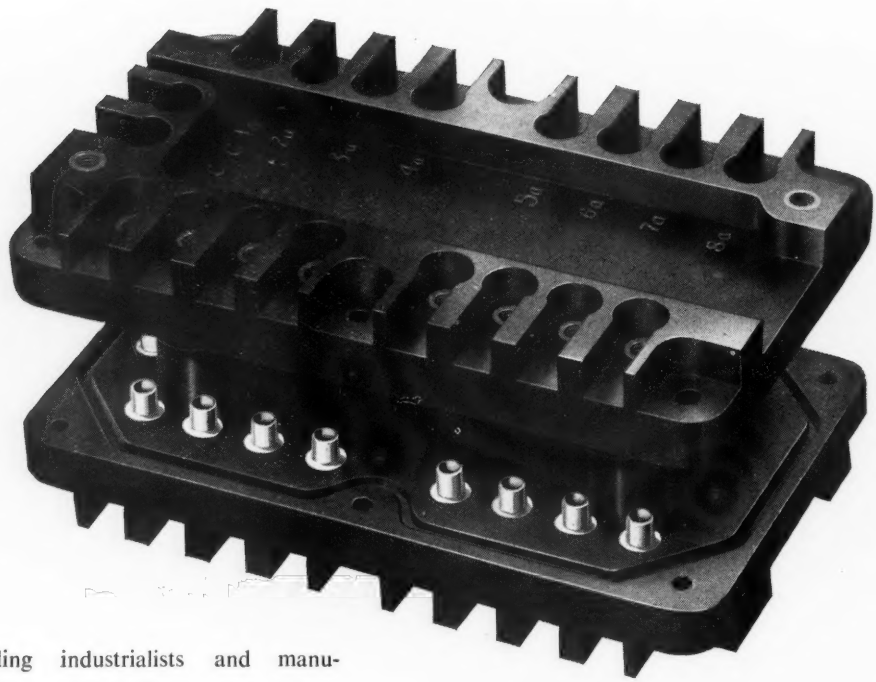

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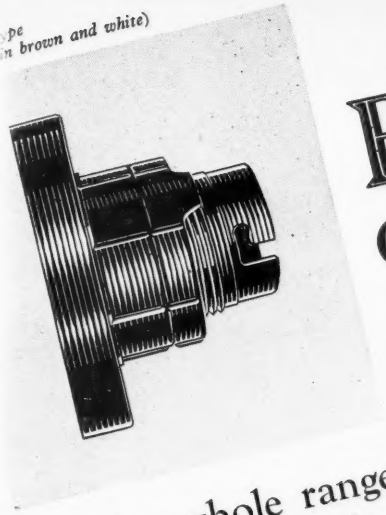

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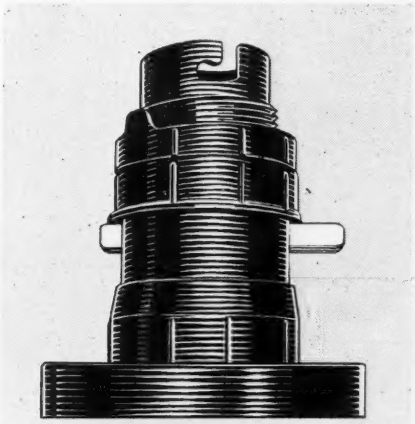

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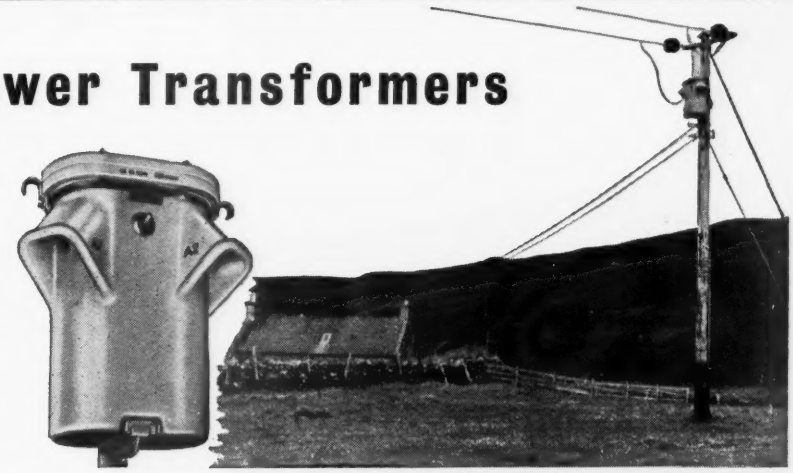

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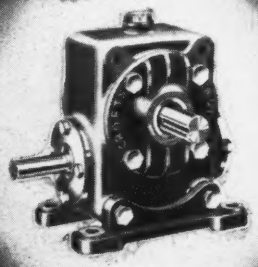

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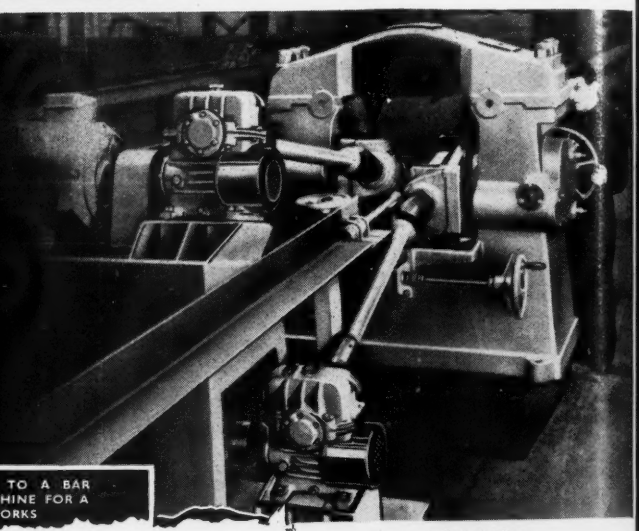

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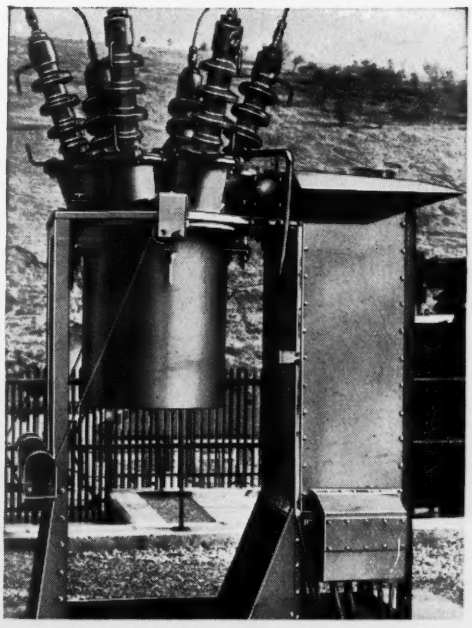

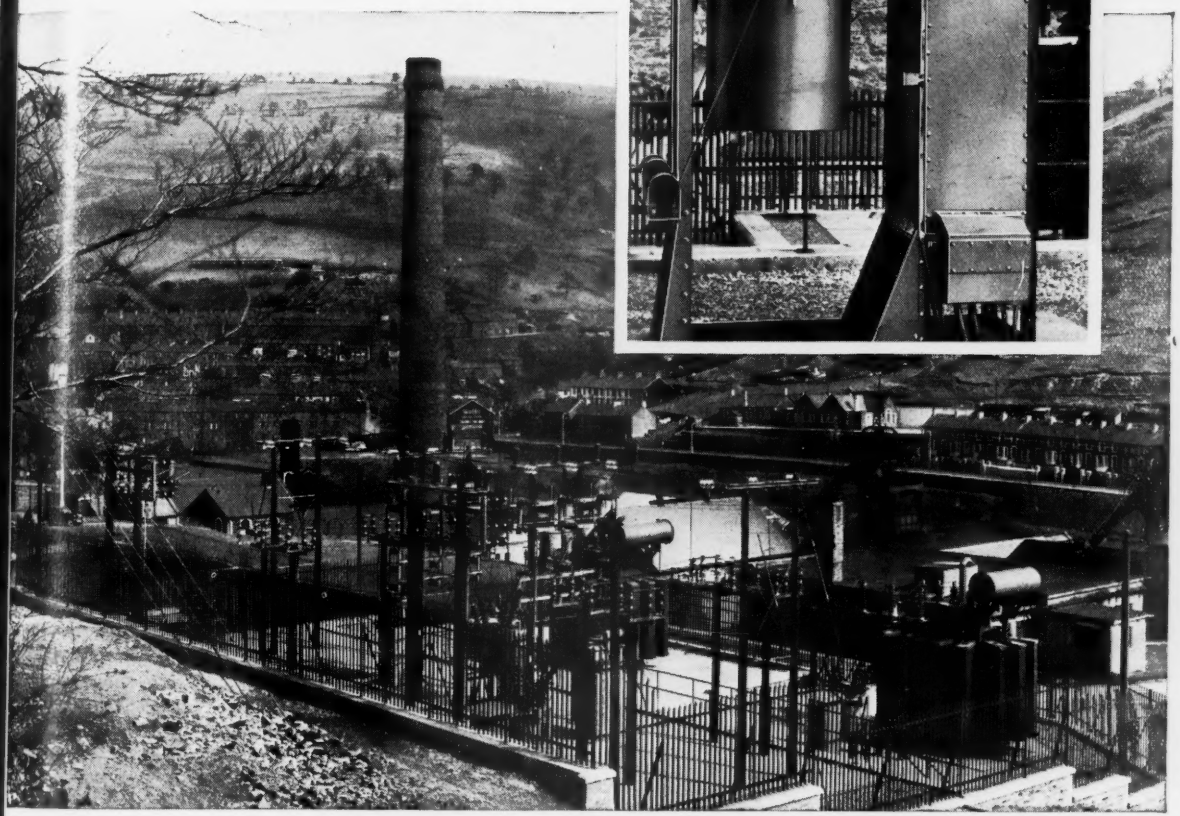

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ELECTRICAL REVIEW

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2 JULY 1954

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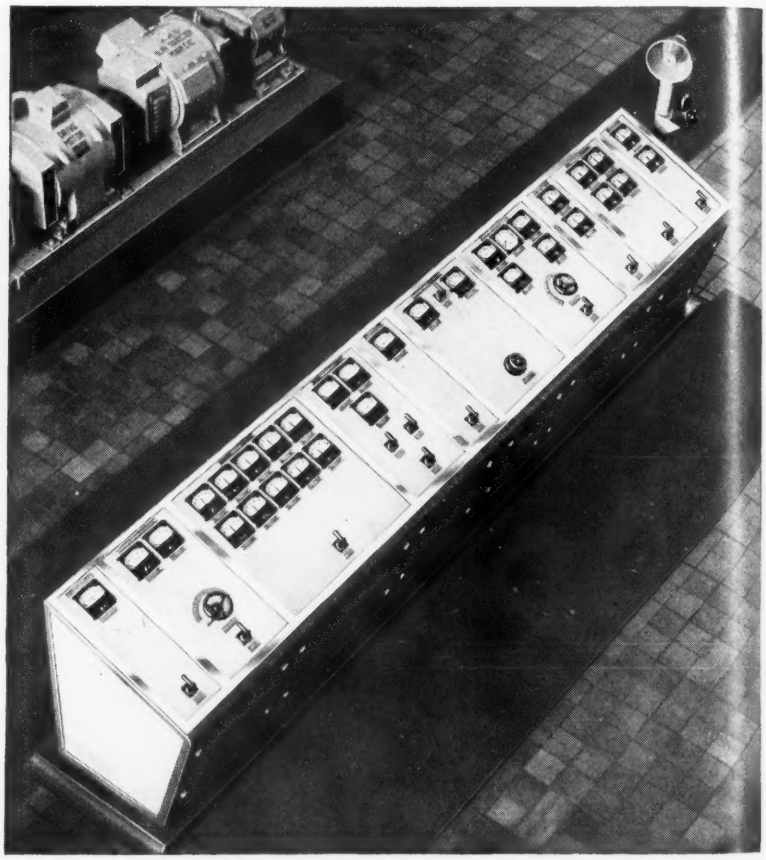

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ELECTRICAL REVIEW

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Industrial Steam and Power

In the absence of authoritative information, except as regards a relatively few large and successful installations, widely divergent views have been rife regarding the extent to which the generation of electricity is or could be economically combined with the production of steam for industrial processes and workshop heating. The data tabulated by a fact-finding committee appointed by the Minister of Fuel and Power last year should do much to clarify the position. With commendable promptitude the particulars obtained have been included in the Fuel and Power Digest for 1953 and the main features of this inquiry were given by us last week when announcing its publication.

From the technical angle a most important consideration is that the difference between the steam pressure required for use in a factory and the maximum boiler pressure (both in absolute terms) should be as wide as practicable, as this governs the amount of electricity that can be generated. The electrical output obtainable from 1,000 lb/hr of steam flow is known to be of the order of 10 kW with a pressure ratio of between 1.5 and 3 and 30 kW if the ratio is above 6. Since nearly 90 per cent of the 11,000 boilers included in the returns are operated at less than 200 lb/sq in, the biggest apparent gain would come from raising initial steam conditions.

If an average pressure ratio of 5 could be achieved, it appears probable from the tables that the amount of electricity annually obtainable from back-pressure and pass-out sets would be increased from 3,000 million kWh (40 per cent of the total generated at the establishments covered) to well over twice that figure. The large replacement of boilers this improvement represents would not be so formidable a question as it might seem, as some 4,000 of these are Lancashires, two-thirds of which are more than forty years old.

Because of the great variations in conditions of production and use, no attempt is made in the report to estimate the national potential for increased use of plant of the types under discussion. The chief functional value of the statistics presented will probably be in enabling a works engineer to decide whether a *prima facie* technical case exists for incurring the expense of improving his present methods or for generating the whole or part of the electricity he requires. In this he could call upon the wide experience in this field which is pursued by the Ministry's Fuel Advisory Service and by many consulting engineers. Regarded from the national standpoint, account should be taken of the quality of fuel required to generate electricity at factories compared with that burned at B.E.A. power stations and also of the question as to how much of the plant manufacturers' resources can desirably be allocated to building relatively small plant for circumstances that vary widely.

POWER FACTOR CORRECTION

The papers and discussions at the recent British Electrical Power Convention have given rise to a good deal of controversy on load factor and its improvement, and as is usually the case this is provoking thought on an allied problem—power factor and its correction. The two electricity supply conditions, load factor and power factor, have one important thing in common; encouragement in the improvement of both is given to the consumer by way of tariff adjustments. Certainly under specific conditions the loading of cables and all manner of generating and distribution equipment with wattless current can be as big a nuisance as deep valleys and sharp peaks in the load curve. For a long time there have been considerable differences of opinion over the methods by which poor power factor should be corrected. But generally the problem has been resolved into two methods, each with its own particular field of performance, bearing in mind that each individual case has its own economics, which demand consideration of the capital expenditure on the correction equipment. Generally, however, for power factor correction on supply and large factory distribution systems the synchronous rotary machine, particularly where it can be used for machine driving, a rolling mill in a steelworks, for example, seems to have won high favour, while the static condenser has become a very popular equipment for smaller schemes and particularly for local correction, although large units are also in use.

POWER TRANSMISSION

Too often are the problems associated with the transmission of power from the driving motor to the driven machine dismissed as outside the province of the works electrical engineer. Nothing could be more misleading and one might just as well say that the control of the driving motor has nothing to do with the works engineer. This officer is a specialist in electrical applications in the factory, and as such foremost among his responsibilities is the design of the correct power transmission conditions. Every machine, whether multiple or single, has a specified speed at the driving head or pulley, depending on the rate of production output of the machine, and it would be quite impracticable to produce motors without limitations to the available speeds. Thus in every case there must be a calculated choice of system—direct coupling, gearing, flat and V-belts, chain drive, and so on—to bridge the gap between the two speeds, and this necessarily has a very close relation to the speed-reduction or speed-increasing ratio involved in the scheme which must sometimes embrace countershafts and pulleys and single and multiple train gearing. The problem becomes even more complicated where variable speed is called for.

PLANT POSITION IN EUROPE

The trend in Europe towards the adoption of the most advanced designs of generating plant having the highest thermal efficiency to meet the rapid growth of load has led to an apparent paradox. A survey of deliveries and orders of heavy equipment for power stations for the twelve months ended 1st October last, which has been prepared by the Organisation for European Economic Co-operation, shows that delivery times are improving and also that manufacturers' productive capacity as a whole is now under-employed. A major cause is no doubt that large modern generating units occupy less factory space and can be built more quickly than smaller sets having the same aggregate rating. The position can be expected to adjust itself, however, as a result of the encouragement which is now being given to further electrification through the consequent maintenance of electricity prices at a low level compared with the rising prices of other commodities.

"VISIBLE" HEAT

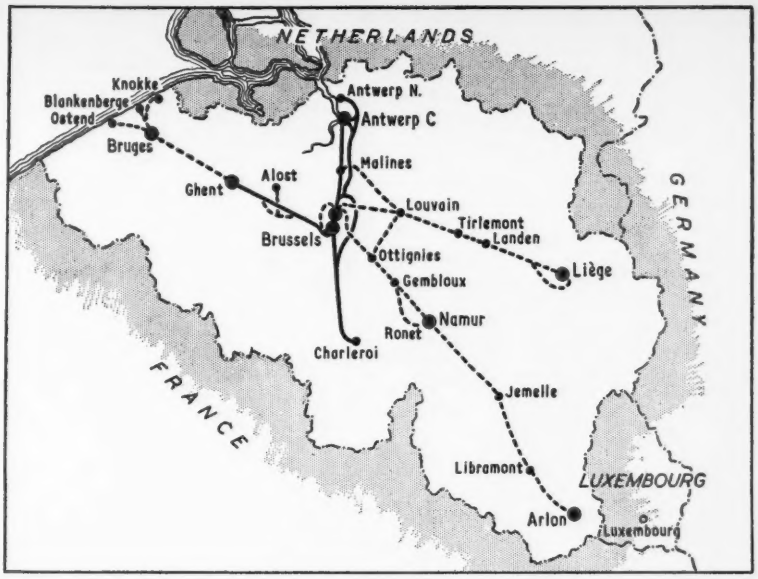
There is a good deal of talk nowadays about the alleged demand for "visible" heat by the housewife in connection with the domestic cooker and particularly the boiling plates. In the first place this seems to be psychology in salesmanship because what is referred to as visible heat is really light. But we suspect that this is a revival of a similar false idea put forward in the 1930's when a little research soon revealed that what was really called for was rapid transfer of heat or quick boiling. The problem was solved by the radiant tubular sheathed element and the low voltage very high current transformer fed boiling plates which pleased the housewife by reducing boiling times and not because she could see the metal glowing. If visible heat is so much desired on the hob, then why not inside the oven? Whoever heard of a grumble in this way in connection with the most popular of all electrical appliances, the electric kettle, without visible heat?

FORTY YEARS OF SERVICE

Representatives of the Electrical Wholesalers' Federation, and their guests, at last week's luncheon celebrating the Federation's completion of forty years were obviously impressed by the sincerity of Lord Citrine's remarks upon industrial combinations. Lord Citrine does not share the view of some trade unionists that while it is proper that they should combine, there is something wrong in employers associating in the same way. He repeated what he had said at the Eastbourne Convention that he preferred to rely on fair treatment by the associations with which he had dealings than to encourage compulsory methods. He considered that no association could continue if it did not have regard to the public interest. We have always maintained that the public interest is served by genuine wholesalers who provide a service for both manufacturers and retailers which does not add to the cost of the product to the public. The fact that the E.W.F. has existed for forty years and still flourishes is testimony to this. The names of many of the Federation's members are as much household words in the industry as those of the leading manufacturers.

Belgian National Railways

SURVEY OF THE ELECTRIFICATION PROGRAMME

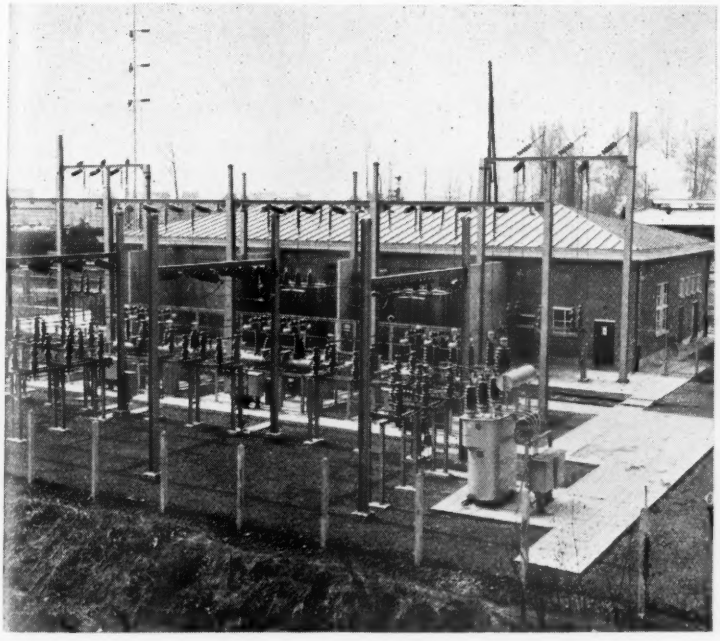


Map showing the lines of the Belgian National Railways which are being electrified

THE electrification of the Belgian National Railway system is being carried out at 3,000 V d.c. and up to the present four lines have been electrified: Brussels Nord to Antwerp Central (in 1935), Brussels Midi to Charleroi (in 1939), Linkebeek to Antwerp Nord (in 1950), and Brussels Midi to Ghent (in 1954). To these should be added the six tracks of the Nord–Midi loop, which connects the Nord and Midi stations in Brussels. The map shows these lines together with those where electrification has already been decided upon and on which work is in progress. This partial electrification programme will be completed in 1956. There will then be 790 km of electrified lines (representing 16 per cent of the whole system); these will carry 40 per cent of the total goods traffic and 50 per cent of the passenger traffic.

The grid system in Belgium is highly developed so that adequate supply facilities are available for the establishment of traction substations wherever they may be required. Belgian traction substations consist of three parts: a three-phase h.v. station (of the interior type for voltages not exceeding 36 kV and of the outdoor type for 50 kV and 70 kV); the feed transformers of the rectifier groups, arranged in cells in the open air; and a 3,000 V d.c. station, containing the six-phase steel-tank fan-cooled rectifiers with their auxiliary equipment, as well as the d.c. distribution system.

Substation at Denderleeuw (between Brussels and Ghent). Foreground: a.c. high voltage section; background: 3,000 V d.c. building with two transformers



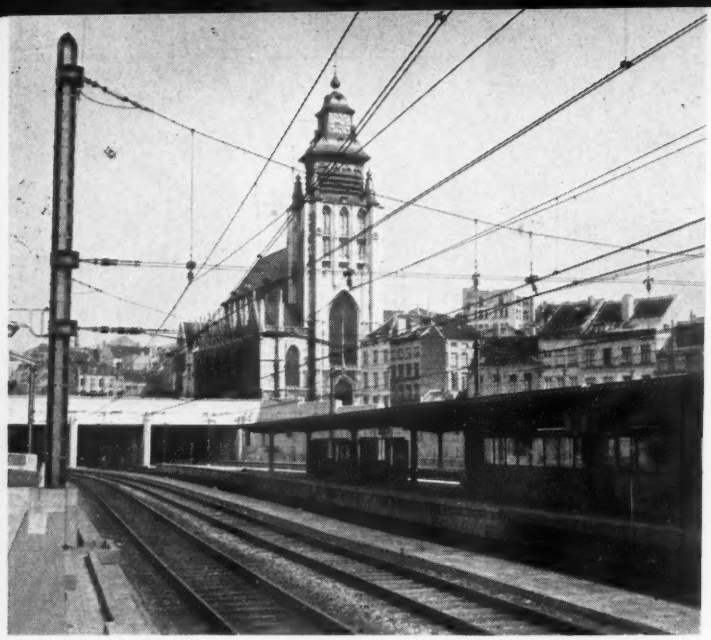
Study of a programme for the electrification of 1,500 km of lines led to the decision to use 3,000 kW rectifier units and since the electrification of the Brussels–Charleroi line this type has become standard. The protection of the catenary suspension trolley wires is ensured by ultra-high-speed circuit breakers.

About half-way between the substations there is a section box and multiple junction box which includes an ultra-high-speed circuit breaker for each section of line which ends at this box. A feed box is sometimes installed in the large stations or at important forks along the track.

In the present stage of development, the substations are permanently staffed, but it is intended ultimately to make them remote controlled, and the equipment of the substations and section boxes has been fitted with this in view.

In 1935 the Belgian National Railways adopted trolley wires of the compound type (principal carrier cable, auxiliary carrier wire and two contact wires) and this system has been retained. In certain cases, however, use is made of simple catenary suspensions with one or two contact wires or of a simple tramway type suspension (groups of lines in stations and yards).

Until 1950, the lines of the two tracks were permitted to be suspended on independent supports consisting either of latticework posts or of I-beams with large flanges. Since then the lines have been suspended on rigid gantries, all the units of which are made up of I-beam section irons with large flanges, spaced at 63 m on straight sections.



Entrance to the tunnel of the Nord-Midi system, Brussels, taken from the Chapelle station

TABLE I

Date of entry into service ...	1935	1939	1946	1950	1951
Number	12	8	1	25	1
Number of coaches per rail-car	4	2	2	2	2
Maximum speed (km/hr) ...	120	120	140	105	140
Total length (metres)	90·36	43·04	44·342	44·402	45·78
Seating capacity	358	145	164	170	161
Standing capacity	55	100	125	100	—
Total capacity	413	245	289	270	161
Percentage of 2nd class	33	18·5	8·3	19	26
Percentage standing	13·5	41	43	37	—
Unladen weight (tons)	242	110	110	93	78
Laden weight (tons)	274	128	136	116·5	92
Horse-power	2,120	1,060	1,060	1,060	1,060
Specific power under load (h.p./ton)	7·76	8·28	7·80	9	11·5

TABLE II

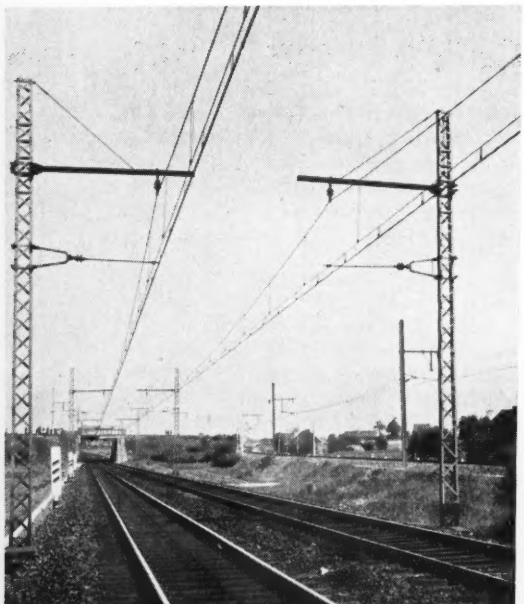
Probable year of taking into service	1954	1955
Number	79	8
Number of coaches per rail-car	2	2
Maximum speed (km/hr)	120	1[illegible]0
Total length (metres)	45·28	5·68
Seating capacity	188	1[illegible]3
Standing capacity	68	[illegible]0
Total capacity	256	[illegible]3
Percentage of 2nd class	12	5·5
Percentage of standing room	26·5	9
Unladen weight (tons)	85·3	6·3
Laden weight (tons)	105·5	1[illegible]3
Horse-power	1,060	1,0[illegible]0
Specific power under load (h.p./ton)	10	9·1

In the large passenger and goods stations the lines are generally suspended on gantries astride all the tracks. This arrangement dispenses with supports in the spaces between the tracks, facilitates the observation of the many signals installed in stations and avoids the risk of the supports being overturned in case of derailment.

The mechanical tension of the contact wires is regulated by means of automatic counterweight tension devices installed at about every 1,200 m. The principal and auxiliary carrier cables are interrupted only at the section divisions. On the tracks outside the stations these section divisions are carried out by the " air film " method; in the stations, and for the trolley wires connecting the main tracks, these section divisions are carried out by means of special indicators which will allow the pantographs to pass.

The tracks at platforms may be either insulated separately or in groups; the lines outside the stations may be split up into sections, both to facilitate maintenance and to simplify fault location. The corresponding sections are normally shunted by disconnecting switches, which are often remote controlled, and can be operated on load. The protection of the lines against lightning is carried out by over-voltage fuses installed in the substations and section boxes (there are also excess voltage fuses on all the rolling stock).

At present the Belgian National Railways have available 47 electric rail-cars and 26 electric locomotives, representing rolling stock supplied during the years from 1935 to 1950. A further 15 rail-cars and 50 locomotives are in the process of being supplied. Two sets of rail-cars comprising 79 and 38 units respectively are on order, as well as 83 locomotives. Table I gives a summary of the principal characteristics of the 47 rail-cars in service at the moment. The 15 units under construction are identical with those put into service in 1950.



Left: Overhead lines between Brussels and Antwerp (independent poles) built in 1935

Below: Lines between Brussels and Ghent erected in 1954 without independent poles

The rail-cars dating from 1935 and 1939 are fitted with fully suspended motors, with elastic transmission on the Sécheron system (hollow axle and helicoidal springs). The first were intended for express trains, whereas those of 1939 were for local stopping trains, which explains the high proportion of standing accommodation. The h.v. equipment includes individual electro-pneumatic contactors or camshaft controlled contactors (this camshaft being driven by pneumatic motor). The number of notches is 13, and there are three economical running positions (series, series-parallel full field, series-parallel 45 per cent shunted).

The 1946 rail-car is a prototype intended to continue an experiment started earlier with four nose-suspended motors (but this time for speeds of 140 km/hr), and to try out lighter starting equipment, with 22 notches, with contactors controlled by camshaft driven by an electric motor according to the JH system (Jeumont-Heidman). The JH equipment had already given satisfactory results, mainly on the rail-cars of the Paris Métro and on those of the Paris–Le Mans line.

The 25 rail-cars brought into service in 1950 were ordered on account of the electrification of the Brussels–Charleroi line. Their construction is lighter than in the preceding cases, and the JH starting equipment was installed in them after the test carried out on the 1946 prototype. Their maximum speed is restricted to 100 km/hr to reduce the consumption of electric power by stopping trains (more rapid elimination of starting resistances). For the first time general use was made of electric lighting using fluorescent tubes (fed by d.c.).

The rail-car brought into service in 1951 is a prototype built in the workshops of the Belgian National Railways with a view to carrying out tests at 140 km/hr. Table II gives the characteristics of the new rolling stock intended for future electrification. The mechanical parts were designed in the planning offices of the Belgian National Railways. The electrical equipment is the same in principle as that in the 1950 rail-cars, but the builders were asked to lighten certain units, mainly the pantographs, the starting resistances, the contactor boxes, etc.

Electrical equipment of the JH system is fitted on all this rolling stock. The motors are nose-suspended, and the transmission is by rigid gears. All the bogies are fitted with a traction motor. The bogie chassis are made of cast steel. The guiding of the axle boxes is carried out by connecting rods according to the system already used by Alsthom on a large number of locomotives of the French National Railways, in Holland and in Spain. The axle boxes run in roller bearings.

It was on the occasion of the electrification of the goods service between Charleroi and Antwerp Nord (an important marshalling yard serving the port of Antwerp) that the need first arose for the Belgian National Railways to have some electric locomotives. These also had to be used for towing or pushing steam trains through the tunnels of the Nord–Midi loop in Brussels.

Studies of locomotives were carried out during the war and the Belgian National Railways chose the BB type, having a weight of 80 tons, with nose-suspended motors, a power of 2,200 h.p. and a maximum speed of 100 km/hr. The locomotives would be suitable for towing both passenger and goods trains. Twenty-six locomotives were required.

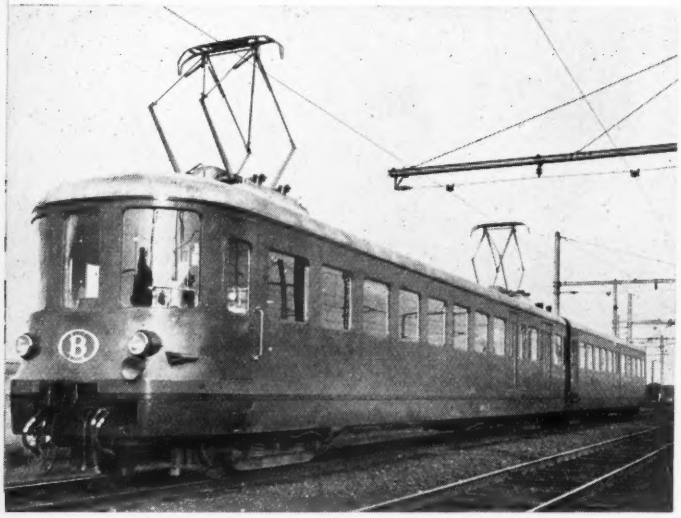
While Belgian manufacturers sent in an offer for locomotives of this type, a Swiss concern proposed the purchase of three locomotives similar to the machines Ae 4/4 used by the Berne–Loetschberg–Simplon Company (but naturally designed for 3,000 V d.c.), with bogies according to the S.L.M. (Winterthur) system, motors completely suspended,

New signals are installed before electrification of the track. For a straight run only the vertical arrow is illuminated together with the green lamp. For the deviated run, the other arrow and figure 2 (maximum speed 20 km/hr) are illuminated together with the coloured lamp

New electric signal. The figure 5 appears indicating a speed limit of 50 km/hr (normal maximum speed in the Nord–Midi junction). Platforms of Chapelle station and entrance to tunnel in the background

Brown-Boveri disc transmission and a maximum speed of 130 km/hr. The Belgian National Railways agreed to try these out.

The Belgian manufacturers, when invited to present an offer for mixed high-speed locomotives, put forward a different solution: nose-suspended motors with unilateral transmission using rigid gears (according to the American method), and bogies with horn plates. It was in this way that the Belgian National Railways began their tests with electric traction by locomotives belonging to three different



Double electric motor coach built in the Malines workshops of the S.N.C.B. in 1951. Maximum speed: 140 km/hr; axle-hung traction motors

types. The characteristics of these types are summarized in Table III.

These locomotives were supplied in 1949/1950 and were immediately put into service for towing passenger trains and goods trains with a load which could reach 1,800 tons on the level, and with double traction for 1,400-ton trains on the Brussels–Charleroi line (with gradients of 13 mm/m).

In view of the programme of rapid development in electrification, the Belgian National Railways soon found themselves faced with the problem of choosing from among these three types for their future lines. Fifty locomotives (series 122) had to be purchased for the Brussels–Ostend and Brussels–Liège lines and a further 83 (series 123) locomotives were necessary for the Brussels–Arlon line and its branches (Ottignies–Louvain and Louvain–Malines, as well as the Gembloux–Ronet section which is reserved for goods traffic).

The choice was guided by the criterion of satisfying certain important conditions: the use, as far as possible, of equipment and units which were identical with those already in service; the choice from among the units in service of those which had reached the highest stage of improvement and development while at the same time offering sufficient guarantee of good working; the adoption of systems which had already been tried out in actual service, which offered ease of maintenance and overhaul, and which simplified the running of the train; while taking the above considerations into account, the purchase price had to be the lowest possible and the cost of operation the minimum.

The new locomotive, series 122, is a carefully worked out combination of the particular features of the locomotives of series 120 and 121 (locomotive 120 already possessed certain features in common with locomotive 101: pantographs, ultra-high-speed disconnecting switch, motor-fan groups, motor-compressor groups). Table IV gives the general characteristics of locomotive 122.

The supply of these locomotives commenced at the beginning of the current year and is continuing at the rate of one a week. Some of these locomotives are already in service on the Brussels–Ghent line and the Nord–Midi loop. The bogies are built in Belgium under an S.L.M. (Winterthur) licence. The principles of these bogies are well known, and bogies of this type are also used elsewhere, on the latest locomotives of the Swiss railway system (Ae 4/4 of the Berne–Loetschberg–Simplon line, Re 4/4 and Ae 6/6 of the Swiss Federal Railways, and Ge 4/4 of the Rhaetian Railways) and on prototype locomotives of the French National Railways.

The traction motors are identical with those of the locomotives of series 120 (the difference in power is solely due to a modification in the rules of definition laid down by the International Electrical Engineering Committee). They are of the series type, without compensating windings, and can be shunted 72 per cent. The electrical equipment incorporates contactors controlled by camshafts.

The equipment is grouped into blocks. One of these blocks comprises the starting resistances with their fans, two camshafts controlling respectively the 33 contactors of the resistances and couplings and the 10 contactors of the shunting, control and safety relays, and the electro-magnetic contactors of the auxiliary motors. Another group comprises the ultra-high-speed disconnecting switch and the auxiliary apparatus.

The starting of the locomotive is automatic. There are four economic running positions in series (full field and different positions of shunt) and six in the series-parallel coupling. Starting is carried out under the control of an acceleration relay, the setting of which may be regulated as desired by means of a control installed on the driver's switchboard. These locomotives, like the preceding ones and like the electric rail-cars, are controlled by a single driver and the equipment is fitted with a "dead-man's" handle.

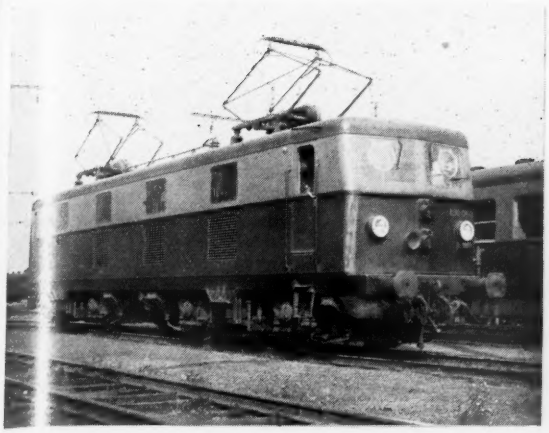
The locomotives of series 123 are the subject of studies being carried out in conjunction with the builders. They will also be of the BB type but their weight will be 92 tons. Their motors will be identical with those of series 122.

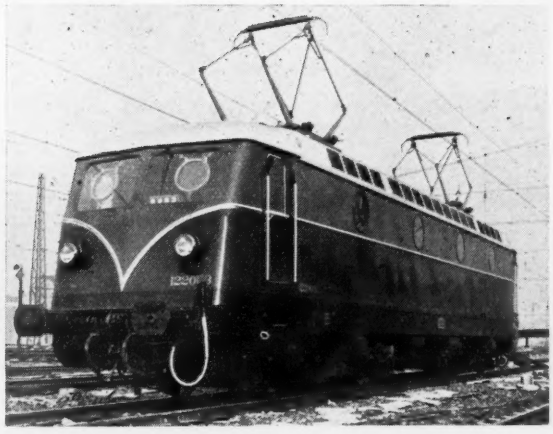
TABLE III

Series number	101	120	121
No. of locomotives	20	3	3
Weight (tons)	81·5	81	81
Max. speed (km/hr)	100	125	130
Total length (m)	12·89	17·18	16·30
Wheelbase of one bogie (m)	2·95	3·50	3·60
Distance between pivots (m)	6	8·5	8
Horse-power (one hour)	2,200	2,700	2,800
Horse-power (continuous)	1,800	2,200	2,340
Suspension of motors	Nose	Nose	Elastic
Transmission	Bilateral	Unilateral	Unilateral–B.B.C. discs
Gears	Elastic	Rigid	Rigid
Starting equipment	Electro-pneumatic contactors, manual control	3 camshafts, automatic control	3 camshafts, automatic control
Starting resistances	Natural ventilation with cast-iron grids	Bands, forced ventilation	Forced ventilation with cast-iron grids
Makers:			
Mechanical parts	Baume et Marpent (Morlanwelz)	Baume et Marpent (Morlanwelz)	Forges, Usines et Fonderies (Haine-St-Pierre)
Electrical parts	ACEC–SEM	ACEC–SEM	Brown-Boveri

TABLE IV

Series number	122
Number of locomotives	40
Weight (tons)	82
Maximum speed (km/hr)	125
Total length (m)	18·0
Wheelbase of one bogie (m)	3·45
Distance between pivots (m)	8·60
Horse-power (one hour)	2,560
Horse-power (continuous)	2,360
Suspension of motors	Nose
Transmission	Unilateral
Gears	Elastic
Starting equipment	2 camshafts
Starting resistances	Bands, forced ventilation
Constructors:	
Mechanical parts	Ateliers Métallurgiques de Nivelles
Electrical parts	ACEC–SEM





BoBo locomotive, series 120 and (right) BoBo locomotive, series 122

The electrical equipment will be similar but will be completed by regenerative electric brake equipment.

The work of electrification has brought with it in many places important alterations to stations as well as far-reaching modifications in the signalling arrangements. Advantage has been taken of this fact to bring about the general substitution on electrified lines of luminous signalling for systems using signalling arms. A type of luminous signal is being used which, besides the normal lights, has a panel for indicating direction (luminous arrows) and one to indicate speed restrictions (luminous figures).

The Belgian National Railways are electrifying a part of their system because electric traction makes it possible to modernize running and to win back for the railways a proportion of road traffic (increased frequency of trains, increased speed of passenger and goods trains), reduces running costs and does away with arduous duties which make the recruitment of staff difficult.

Alongside their programme of electrification the Belgian National Railways are also making a great effort to modernize their stock of locomotives for use on secondary lines, for main lines for which electrification would not be a paying proposition and for shunting operations in large stations. During the last few years they have ordered a large number of diesel rail-cars, 95 diesel-electric locomotives and 100 diesel shunting engines.

The results which have been obtained from electric traction have come up to expectation. At the present moment studies are being carried out in connection with neighbouring systems with a view to the electrification on a basis of 3,000 V of the Arlon–Luxembourg section, and also in regard to the production of combined 1,500/3,000 V rail-cars which would make possible direct connections between Amsterdam and Brussels.

Although in 1935 the Belgian National Railways chose the 3,000 V d.c. system and although they have no reason to regret this choice, they are nonetheless following with a great deal of attention the new techniques of electric traction.

Northern Ireland Board's Report

SOME details have already been published of the progress made last year by the Electricity Board for Northern Ireland (*Electrical Review*, 18th June, page 1157). Amplifying this information, the Board's annual report gives the following table showing the increase in sales of electricity and consumers connected during the past ten years. New consumers last year included 1,448 farms (making a total of 7,966) and 3,527 other rural users, who thus outnumbered new urban consumers. It is noteworthy that since 1939 there has been a rise of only 16·57 per cent in the average price received per kWh sold although the cost of coal has advanced by over 217 per cent. A marked improvement in the textile industry and the establishment of other new industries both contributed to last year's increase in output. Public lighting was also a feature of development, 1,531 new lamps being connected. At the end of the year there were 11,537 metal filament, 1,793 mercury vapour, 1,448 fluorescent and 39 sodium public lamps in use.

Year	Sales million kWh	Per cent increase	Total consumers supplied at end of year	New consumers connected	Average price per kWh sold
1944	100·3	14·0	45,999	857	1·38d
1945	101·8	1·4	48,307	2,308	1·40d
1946	111·1	9·2	52,652	4,345	1·42d
1947	140·4	26·4	76,376	23,724	1·48d
1948	179·8	28·0	83,066	6,690	1·56d
1949	217·5	20·9	92,586	9,520	1·54d
1950	251·7	15·7	100,885	8,299	1.53d
1951	291·2	15·7	109,506	8,621	1·54d
1952	302·3	3·8	117,489	7,983	1·76d
1953	335·3	10·9	126,235	8,746	1·76d

Despite a recession in the first quarter of the year and reductions in the selling prices of many appliances, the total value of apparatus sold by the Board last year was £100,893 against £90,079 in 1952. These appliances represented an additional connected load of 18,500 kW; they included 2,020 cookers (1,543 in the previous year).

The Board's Ballylumford station generated 448·9 million kWh, the maximum load being 116,900 kW and load factor based on electricity generated 43·84 per cent. The station (installed capacity 124,500 kW) is run conjointly with the Belfast Corporation's Harbour power station (174,750 kW).

The accounts of the Board show that gross revenue amounted to £2,540,731 (against £2,288,750), working costs aggregating £1,812,285 (£1,589,269). After adding interest on investments and providing for sinking fund and other charges there was a net surplus of £790 (£1,010).

Referring to the restoration of the Board's powers to require from new consumers a revenue guarantee or contribution towards the cost of supply, the Board's secretary (Mr. Lendrick McMaster) says that the Board is gratified that it can look forward to carrying out its development works without imperilling the stability of the undertaking. Much time must elapse, however, before it is possible to keep pace with new applications and at the same time overtake arrears of approved works.

Research and Development

The W. M. Thornton Lecture

ON the closing day of the Association of Mining Electrical and Mechanical Engineers' annual convention at Glasgow (15th–18th June) Sir Harold Roxbee Cox delivered the sixth W. M. Thornton Lecture, taking as his subject research and development in engineering. In this he advocated that more of these activities should be aimed at utilitarian objectives with a clear foresight of what the future would demand. He likened the process roughly to a spectrum, in which the red end was the region of invention and of fundamental research and the violet end was the region of new products (engineering); in between was the gradation of applied research, with the analogy of different colours for various stages, which linked engineering (right) to basic research (left).

The left-to-right method was rarely possible and then generally because of the clear vision of one interested party. It could lead to the accumulation of much knowledge which might never be needed, but was necessary as it sometimes led to big dividends, though it needed no propaganda. The right-to-left approach was economical of effect because the researches were just enough to enable investigators to reach their objective, and no more

Britain was immensely strong at the red end of the spectrum, supplying a disproportionately large number of inventors and first-class fundamental scientists. Possibly all the people capable of doing fundamental research were doing it; adequate provision was made for it, and it needed no propaganda. However, it yielded but insufficient consequences at the violet end in the creation of new things and improvement in methods.

An example of the benefit of the right-to-left approach was found in British pre-eminence in civil aircraft which was based on the development of military aircraft. The Government, as consumer, provided for the left-to-right movement in its own research establishments with the aid of universities, and for right-to-left by development contracts to industry.

In the civil sphere, however, the Government generally sponsored work at the red end of the spectrum, thus stimulating left-to-right movements, and the opposite became the field of industry which required new or improved materials and apparatus. Industry had not, however, the same financial resources and often ignored opportunities for developing invention. The last possibility had led the Government in 1949 to create the National Research Development Corporation, which by developing inventions to the prototype stage represented an example of its working across the whole width of the spectrum.

The Government might assume responsibility for development in civilian fields where it was a consumer or where the national interest was unequivocally involved, as in atomic energy. Its Advisory Council on Scientific Policy recommended in 1953 an extension of the placing of development contracts with industry, particularly on projects of a long-term character. The Ministry of Fuel and Power Act of 1945 presented another instance in that the Minister was concerned with research and development in the efficient use and consumption of fuel and power.

Sometimes, however, fundamental work by the physicists had immensely practical results, as in nuclear fission. Thus the idea of jet propulsion belonged to the left hand of the spectrum, but Whittle in working it out proved the right-to-left method, since design, construction and test defined the research problems and secured progressive improvements. Griffith's axial compressor jet propulsion engine, however, was the product of left-to-right synthesis and to-day gas turbine design was based upon knowledge obtained in both ways.

Sir Harold Roxbee Cox delivers the Thornton Lecture at the recent annual convention of the Association of Mining Electrical and Mechanical Engineers

Examples were given of experiments aimed at permitting open-cycle gas turbines to run on coal in a dry combustion chamber (C. A. Parsons & Co.), a slagging combustion chamber (English Electric Co.) and a gas producer to operate at 6 atm (Metropolitan-Vickers). A pilot model of a gas producer had been set up (Incandescent Heat Co. and Joseph Lucas (Burnley)). A closed-cycle turbine to burn coal and slurry had also been built (John Brown).

Defining Requirements

At the conclusion of the lecture Mr. B. L. Metcalf, president, spoke of the tendency to buy machines without giving any clear definition of the practical objectives. If this were done it would enable British manufacturers to get down to designing in terms of that definition. This view was one which the gathering obviously supported and received the approval of Sir Harold, who considered the most logical course was to assess the job and then work backward to specify the kind of machine to be made. He outlined the work done by the Gas Turbine Development Committee, as an excellent example of co-operative research. That work was still continuing and had demonstrated that co-operation was possible, even between competing organizations. In very large organizations it would be difficult to ensure that everyone was in contact with the work involved, and smaller teams were desirable and cited one view that 130 workers constituted the ideal number.

Mr. Love suggested that industry was perhaps less efficient at defining requirements and might copy the Services. Sir Harold, while agreeing, pointed out that even in Service specifications the ultimate definition was the result of collaboration with makers. Mr. D. J. Thomas suggested meetings between the scientists engaged on development projects and the engineers involved at the operational level. Sir Harold thought that such improved contacts must grow out of each organization, and Mr. Metcalf added that in their own work the use of experience and opinion to the best advantage would need to be considered.

In response to a request from Mr. Watson-Jones for a comparison between home and overseas development, Sir Harold said that the curious thing about British industry was that while some firms were the best in the world, others were far behind. We were not doing so well as we might in application. Engineers in Britain had perhaps less influence than in other countries; there was also a lack of risk capital, which was a most serious matter. Somehow or other the means must be found for much more work on speculative designs, and he thought that rather than foster and finance further research work we should make use of the knowledge already available. We had ample stores of knowledge awaiting use and were simply not using it.

Mr. Vaughan Harries proposed the vote of thanks.

Unpublished Work of Heaviside

Fourth Volume of "Electromagnetic Theory"

By H. J. JOSEPHS, M.I.E.E.

HEAVISIDE'S publications are gathered together in the two volumes of his "Electrical Papers" which appeared in 1892, and the three volumes of his "Electromagnetic Theory," the first of which appeared in 1893, the second in 1899 and the third in 1912. The fourth and concluding volume of "Electromagnetic Theory" was never published. In 1913, in a letter to Dr. E. J. Berg Heaviside wrote: "I am trying to get on with Vol. of E.M.T. It is a question of health and freedom from disturbance and petty worries. . . . It is slow work for a old man in any case." In 1914 the first world war came and with it a partial breakdown of his health. Nevertheless, in 1916 the complete manuscript (except for one small item) was practically ready for publication. Dr. Silberstein and the publishers, Messrs. Taylor & Francis, were anxious that Volume 4 should be published in this country and suggested that it should first appear in series form in the *Philosophical Magazine*. In this way they hoped to meet Heaviside's complaint that ". . . Others are publishing work I have in Vol. 4 of E.M.T."

Early in 1917, Dr. Silberstein wrote to Heaviside and offered to see Volume 4 through the press for him, or do any mathematical work that might accelerate the publication. In his letter of thanks Heaviside said he had recently decided to rewrite a small part of the section on "Interference" and consequently was not yet ready to hand over the manuscript; and with regard to the offer of mathematical help he underlined the words ". . . no one can do this work save myself." In 1949 a search through Heaviside's unpublished papers, now in possession of the Institution of Electrical Engineers, showed that the section he referred to was primarily concerned with the analysis of certain experimental results obtained by Prof. D. E. Hughes.

Prof. Hughes was the inventor of the microphone and the printing telegraph and in the year 1886 he was the President of the Society of Telegraph Engineers (later the Institution of Electrical Engineers). In January of that year he delivered his presidential address, during which he showed some wonderful experiments. Heaviside was keenly interested in the analysis of these experiments because he realized that they constituted the first direct evidence in favour of Maxwell's wave theory. He also drew attention to certain reciprocal interactions (or "cross-effects" as he called them) and apparently it was dissatisfaction with his proof of the equality of certain reciprocal parameters that caused him to withhold the manuscript from Dr. Silberstein early in 1917. This demonstration (which could have been omitted) occupied only a very small part of the manuscript and Dr. Silberstein found it difficult to understand why Heaviside attached so much importance to this small item. The reason became clear in 1949 when it was found that Heaviside had treated the Hughes secondary effects as special cases of a more general theory of interference in which the reciprocal parameters played an important part. This theory of interference was based upon a generalization of his duplex force-flux laws and it is of interest to sketch its development.

It will be recalled that Heaviside described his force-flux laws in the first volume of "Electromagnetic Theory." In this description he was concerned with the relations existing between the following sets of quantities:

Quantity	*Magnetic*	*Electric*
Force-intensity	H	E
Flux-density	B	D
Energy-density	T	U
Inductivity	μ	ϵ

H, E, B and D are vector quantities. H and E are force-intensities and are measured per unit length. B and D are densities (of Faraday lines) and are measured per unit area of cross-section. T and U are scalar quantities and are measured per unit volume. μ and ϵ are, in the general case, mathematical functions with operational characteristics.

All the above sets of quantities may, and in general do, coexist at any one point in an electromagnetic field. If this field is a simple non-conducting dielectric medium free from matter, then

$$(1)\ldots\ldots\ldots \text{div } B=0 \quad \text{and div } D=0$$

and the force-flux relationship may be written

$$(2)\ldots\ldots\ldots\ldots B=\mu H \quad \text{and} \quad D=\epsilon E$$

where μ and ϵ are constants. The lines B are due to a distant magnet or magnetizing current; and the rate of cutting of B is E, the electric force, or e.m.f. per unit length. The lines D are due to a distant electric charge or displacement current; and the rate of cutting of D is H, the magnetic force, or m.m.f. per unit length. In the non-conducting dielectric medium considered Heaviside showed that

$$(3)\ldots\ldots\ldots\ldots T=\tfrac{1}{2}HB \quad \text{and} \quad U=\tfrac{1}{2}ED,$$

and also that if P is the vector flux of energy per unit area perpendicular to P, then

$$(4)\ldots\ldots\ldots\ldots P=E\times H+C$$

where C denotes any circuital flux for which div C=0 and the cross $\times$ indicates that the vector product is to be taken.

For the non-conducting dielectric considered, μ and ϵ in (2) are only parametrically constant. For a conducting system μ and ϵ assume the mathematical features given by Heaviside in the first volume of "Electromagnetic Theory." In his second volume he discusses the correlation of these mathematical features with the integrated forms of the force-flux relationship (2). He also showed that in the general case of conducting dielectric systems the flux of energy can be described by generalizing the integrated force-flux relationship into the form,

$$(5)\ldots\ldots\ldots \begin{cases} F_r = \sum_{s=1}^{n} e_{rs} f_s & (r=1, 2, \ldots n) \\ e_{rs} = e_{sr} \end{cases}$$

where the F's denote the generalized flux functions while the f's represent the generalized force functions. Heaviside then treated (5) as a set of phenomenological equations.

By searching through his early notebooks it was found that Heaviside first formulated empirical equations of the type (5) in 1868 at Fredericia, in Denmark, where he was

employed as telegraphist by the Danish Cable Company. He used the equations to calculate the current responses of certain lumped networks; he knew that $e_{rs}=e_{sr}$ indicated reciprocal relations between the voltages and currents and found that most of his networks satisfied this condition. In 1870 Heaviside left Fredericia for Newcastle-on-Tyne and it was here that he established from (5) the ordinary symbolic j method of analysing lumped alternating current circuits in the steady state.

In 1874 Heaviside began to apply (5) to the solution of telegraph transmission problems. He found he could readily write down the descriptive differential equations (5) of a problem from known physical laws; but the solution of these equations sometimes presented formidable mathematical difficulties, and in certain important cases broke down completely. It was this failure of the classical methods that compelled Heaviside to invent those operational schemes of solving (5) that he gives in his second and third volumes of "Electromagnetic Theory." In these two volumes e_{rs} is used to denote $a_{rs}p+b_{rs}$, where a_{rs} and b_{rs} are constants and p represents the differential time operator d/dt. The boundary conditions were such that when the time $t=0$, $f_r=u_r$ where the u's are known constants. In his fourth volume, however, Heaviside concentrated less on operational manœuvres and more on the physical significance of the generalized force-flux expression (5).

Theory of Interference

From the unpublished notes at the I.E.E. it was found that at first Heaviside had accepted (5) as a postulate (as is often done with the fundamental laws of thermodynamics), but later he had studied a large number of empirical laws in order to find out how (5) could be made the basis of a theory of interference. The laws he studied all described irreversible processes in the form of proportionalities, e.g., Ohm's law between current flow and potential gradient; Fourier's law between heat flow and temperature gradient; Fick's law between flow of matter of a component in a mixture and its concentration gradient; Newton's law between shearing force and velocity gradient; Gibb's law between reaction rate and chemical potentials, etc.

When two or more of these phenomena occur simultaneously they interfere and give rise to new effects. Such cross-phenomena are, for example, the two reciprocal phenomena of thermo-electricity arising from the interference of heat conduction and electrical conduction: the Peltier effect (evolution or absorption of heat at junctions of metals resulting from the flow of an electric current) and the thermo-electric force (electromotive force resulting from the maintenance of the junctions at different temperatures). It was cross-effects of this type that were being studied experimentally by Prof. Hughes in 1886 and it was the mathematical description of these effects by virtue of an interference theory based upon (5) that Heaviside intended to publish. Apparently Heaviside's pioneer work in this field was recognized by the Council of the Royal Society for they offered him the Hughes Medal in 1904: but he declined it privately and the offer was not made public.

The correspondence with Dr. Silberstein in 1917 showed that early in the year Heaviside was not happy with his demonstration of the relationship $e_{rs}=e_{sr}$; but later in that year he completed his proof and thereby finished his fourth and concluding volume of "Electromagnetic Theory." After the completion of the manuscript Heaviside now asked Dr. Silberstein to get the publishers to give him an advance payment of £1,000. But potential publishers in this country would not meet this demand and consequently volume 4 was never published here.

In the summer of 1918 Heaviside was in touch with Dr. B. A. Behrend of Boston, Mass., with a view to the publication of Volume 4 in America. From the tattered scraps of old letters now in the possession of the I.E.E., it appeared that Dr. Behrend tried hard to find a publisher who would agree to Heaviside's demand for £1,000 payment in advance. It is possible, therefore, that Heaviside sent one of his two copies of the manuscript to Dr. Behrend. In 1921, Dr. G. A. Campbell sent a letter to Dr. F. B. Jewett (who was then staying with Sir Frank Gill in England) in which he said he had asked Mr. C. E. Spiers, vice-president of the D. Van Nostrand Co. (American publishers of the first three volumes of "Electromagnetic Theory"), for the approximate cost of publishing Volume 4. Mr. Spiers told him that Heaviside's books did not pay and were not expected to do so.

Loss of Manuscript

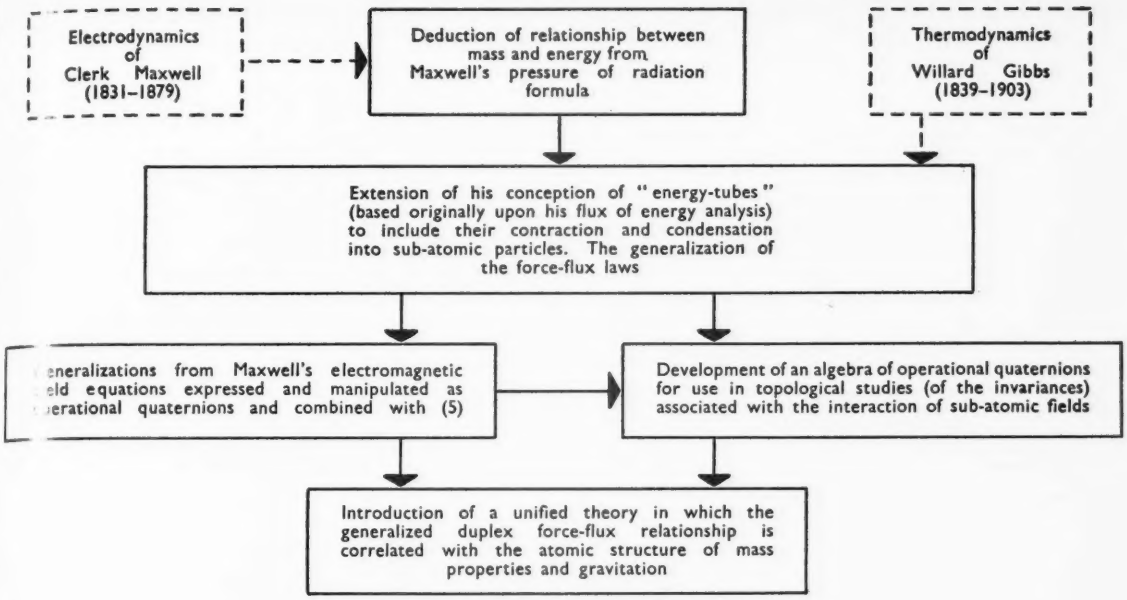
On 3rd February, 1925, Heaviside died at the Mount Street Nursing Home in Torquay. Shortly after the radio announcement of his death that evening his house, Homefield, in Torquay was burgled, and it is possible that Heaviside's own copy of the finished manuscript, upon which he had laboured for over twenty years, was stolen. From the scattered notes, which the burglars left behind, it has been possible to reconstruct some of the features of the fourth volume.

In 1927 many of Heaviside's books, papers and medals were bought by the I.E.E. for the moderate sum of £1.0. The manuscript of Volume 4 was not included in this collection but mathematical notes intended for publication were found scattered throughout the collection. A close examination of these unpublished notes revealed the existence of many new and significant theorems which Heaviside may have developed and included in the manuscript of Volume 4.

In 1933 the books and papers of Heaviside gathered by Dr. Behrend were exhibited at the Massachusetts Institute of Technology by Mrs. Behrend. This exhibition included a number of letters and other *memorabilia*, but the prepared manuscript of Volume 4 was not in the exhibition. Afterwards, in 1936, Mrs. Behrend presented this collection to the I.E.E.

At the start of the second world war in 1939 the question of finding safe protection for the Heaviside collection arose. The collection was divided: some of the books and papers were stored in the vaults of a London bank, while others were stored in the cellars of a house in North Wales. After nearly five years in storage the books and papers were returned to the I.E.E. in 1945. Most of the unpublished work was in the Welsh consignment which was, unfortunately, much damaged by water during transit.

In the spring of 1949 Sir Gordon Radley suggested that if a thorough search failed to locate the manuscript of Volume 4, an attempt should be made to reconstruct some of its features from the unpublished notes; and these features could then be outlined in the Heaviside Centenary Volume and published by the I.E.E. in 1950. A thorough search failed to locate the manuscript. This search included the archives of the Massachusetts Institute of Technology; and, in addition, Dr. J. A. Stratton, the Provost, could find no evidence that this manuscript was ever at the Institute. The results of this search gave little hope of ever being able to find Volume 4; but in the summer of 1949, however, a manuscript draft of a substantial part of the intended fourth volume was discovered. These documents, how-


Electrodynamics of Clerk Maxwell (1831–1879)
Deduction of relationship between mass and energy from Maxwell's pressure of radiation formula
Thermodynamics of Willard Gibbs (1839–1903)
Extension of his conception of "energy-tubes" (based originally upon his flux of energy analysis) to include their contraction and condensation into sub-atomic particles. The generalization of the force-flux laws
eneralizations from Maxwell's electromagnetic eld equations expressed and manipulated as erational quaternions and combined with (5)
Development of an algebra of operational quaternions for use in topological studies (of the invariances) associated with the interaction of sub-atomic fields
Introduction of a unified theory in which the generalized duplex force-flux relationship is correlated with the atomic structure of mass properties and gravitation

Heaviside's scheme for Volume 4 of his "Electromagnetic Theory"

ever, were in a decayed condition and covered with mud, soot and mildew; they were firmly stuck together and any attempt to separate them made them fall to pieces. By careful physical and chemical treatment the tattered documents were restored and made legible by Mrs. B. A. Turner.

A study of these documents showed clearly that Heaviside's views on the nature of the interaction of matter and energy changed after 1904. They show his desire to discover how electrons are made and what goes on in the inside of atoms. After deducing the relationship between mass and energy from Maxwell's pressure of radiation formula, Heaviside appears to have rejected the Maxwell-Faraday interpretation of electrical phenomena as a series of stresses in a continuous medium, and to have modified some of his ideas concerning the fundamental principles of ponderable matter. Problems connected with the fact that mass and energy are inseparable were found and it appears that he formulated a system of non-Newtonian mechanics in which mass is a function of velocity. He then applied his system to the calculation of the characteristics of moving electrons. These calculations led him to postulate the existence of lower limits in the division of space and time, these limits being conditioned upon the presence of energy. The Heaviside space of Volume 4 appears to have no physical meaning apart from energy.

The unpublished work also showed that Heaviside was beginning to think in terms of statistical discontinuity in nature: his new outlook was clear in his calculations of the atomic or particle-like structure of electromagnetic pulses. These calculations were based upon the extension of his theory of energy-tubes (produced by the superposition of electric and magnetic fields on the atomic scale) to include their contraction and condensation into sub-atomic particles. The unpublished notes indicated that he had come to regard physical laws as statistical throughout and based on the natural tendency of matter to go over into a state of atomic disorder: in other words, the unpublished mathematical work is based upon his own view of the action of matter on the atomic scale together with his integration of the electrodynamics of Clerk Maxwell and the thermodynamics of Willard Gibbs plus his scheme for applying n-dimensional impulse functions to the analysis of non-linear effects. An account of some of the theorems intended for the fourth volume will be found in "The Heaviside Centenary Volume" published by the I.E.E. in 1950.

For the purpose of discussing in his fourth volume the characteristics of the invariances associated with the interaction of sub-atomic fields Heaviside introduced the concept of an electromagnetic bivector $Q(=H+jE)$. To aid him in this investigation he also introduced the idea of an operational quaternion capable of condensing Maxwell's equations describing the electromagnetic system $S(x,y,z,t)$ to the simple form $PQ=I$. Also he showed that $P'Q'=I'$ for the system $S'(x',y',z',t')$ implies that the invariants of electromagnetic theory are characterized by $Q^2=0$ and since the electric and magnetic fields can be interchanged in this quaternion by a change of axes, it follows that the two fields are geometrically related quantities (i.e., the electromagnetic strains produced by Q are in the same plane and at right angles to one another).

Plan of Volume 4

Heaviside's scheme for the concluding volume of "Electromagnetic Theory" is shown in the diagram above. This scheme shows that his object had been to develop a unified theory in which his generalized force-flux relationship (5) is correlated with the atomic structure of mass properties and gravitation. Heaviside's first attempt to correlate gravitation with electromagnetism (but omitting atomic phenomena) was published in 1893: reference to this work, namely his field equations on page 461 of the first volume of "Electromagnetic Theory" show that his gravitational expressions are of the same mathematical form as his duplex electromagnetic circuital laws that embody (1), (2), (3) and (4) as special cases. An examination of this analysis shows that he treated the gravitational and electromagnetic fields as the symmetrical and antisymmetrical parts of more general circuital laws.

It is of interest to compare Heaviside's ideas with those embodied in Einstein's recently published theory of the unification of electromagnetism and gravitation. This

theory (which was published in Appendix 2 of the 1950 edition of Einstein's book, " The Meaning of Relativity ") shows that in a Euclidean field the quantities concerned separate into a symmetrical and an antisymmetrical tensor, one set satisfying equations of the electromagnetic type, and the other set satisfying equations of the gravitational type. Thus Einstein's analysis confirms Heaviside's ideas in this connection, but his method of establishing the field equations is very different. After generalizing the Riemannian tensor Einstein used a variational method to obtain his field equations and then introduced charged gravitating particles to account for the singularities.

Einstein's analysis shows clearly that the ideas of curved space (Heaviside called this " twisted nothingness ") are unnecessary for the development of a unified field theory that excludes atomic phenomena. This, however, may not be true if Einstein's unified field theory has to be extended to include the atomic structure of mass characteristics. Einstein does not appear to have discussed the problem of complete unification; but Heaviside spent many years in studying this problem and actually arrived at a solution which he intended to publish in his concluding volume of " Electromagnetic Theory."

One of the outstanding features of the fourth volume is its theory of interference: this theory, which is based on (5) and makes use of Gibbs' " open system " equation (in one or other of its various forms) enables the rate of creation of entropy in natural processes to be calculated. Another feature is the unified field theory which is in good agreement with observations. There can be but little doubt that Heaviside was well satisfied with his manuscript of Volume 4. Many years may pass before the great merit of this manuscript is appreciated, but sooner or later the work of interpretation will be done. Then the reputation of Heaviside, great as it now is, will become yet greater.

RAPID STARTING OF POWER PLANT

TO gain reliable basic information on the suitability of large power plant for rapid starting after a short shut-down period, tests were carried out over a two years' period at Poole power station, the results of which were given in a paper presented before the Institution of Mechanical Engineers by Messrs. J. S. Hall (Metropolitan-Vickers) and A. F. Brittin (Superheater Co.).

They showed that the rate of starting of the 50 MW turbine need be limited only by the rate at which the various starting operations could be performed, provided the steam temperature at the inlet to the steam chest could be maintained between 150 deg F above and 50 deg F below that of the inlet end casing. A steam temperature of more than 50 deg below the metal temperature might be tolerable, but there was some evidence that cooling itself could promote vibration apart from retarding the essential heating process.

Boiler pressure was not important if the requisite flow and temperature were obtained. Not more than half load should be carried until the designed steam temperature had been reached.

Two boilers and one turbine were segregated to form a unit and proved well suited to rapid starting after a shift shut-down without steam dumping; this combination permitted control of boiler-output steam temperature throughout the starting and loading periods over a sufficient range to maintain optimum conditions at the turbine. In these tests the aim was reliability rather than speed, but reliability was obtained with greatly increased starting speed compared with tests without temperature control. Cooling rates of piping need not be so much in excess of those of the turbine as to require special measures for heating the piping.

CIVIL ENGINEERS' CONVERSAZIONE

ON Thursday of last week the Institution of Civil Engineers held its annual conversazione in London, in connection with which the customary exhibition of models and apparatus was arranged.

A scale model of a proposed wave suppressor for the cooling water outfall flume of Dekhelia power station, Cyprus, was shown by the Hydraulics Research Station of the D.S.I.R. Here, cooling water for the steam turbines is pumped from the sea and returned to it in a concrete flume 8ft wide and 7ft deep. During storms, with an adverse wind, waves of up to 3ft in height travel upstream to the head of the flume where they break and splash the steelwork of the station, causing rapid corrosion. The model—a 1/24th scale replica of the flume—shows how such waves can be destroyed or rendered harmless by placing in the flume a standard broad-crested weir of sufficient height to result in the formation, downstream of the weir, of a stationary breaking wave (the " standing wave " or " hydraulic jump ") in which the surplus energy of the stream, owing to its fall in level, is converted into heat. As each travelling wave arrives, the quantum of energy it carries tends to be lost in the turbulent region of the standing wave, the front of which moves upstream and then recedes. In this to-and-fro motion, if the wave-front fails to reach the rounded portion of the weir, the train of travelling waves is completely intercepted, leaving the surface upstream of the weir entirely undisturbed; if not, the travelling waves pass over the weir and resume their upstream march, but with their height reduced to harmless proportions.

Another exhibit, by Mr. C. H. Pickworth (Messrs. Preece, Cardew & Rider) comprised an artist's impression of the Dekhelia generating station. This semi-outdoor station is oil fired, fuel being delivered through a submarine oil pipe line, and is designed for a total installed capacity of 70 MW. Steam conditions are 425 lb/sq in and 770 deg F.

A model of two of the eight pulverized fuel fired boiler units for the Portishead " B " power station of the British Electricity Authority was shown by Mr. H. D. Watson (Mitchell Engineering, Ltd.). Construction of the first two-thirds of the station is now proceeding, and covers eight boilers and four turbo-alternators, having a total output of 240 MW. The complete station is scheduled to contain twelve boilers and six turbo-alternators (360 MW).

A model of a colliery power station housing five 1,100 b.h.p. " dual-fuel " generating sets was shown by Mr. R. W. Stuart Mitchell (G.E.C.). This station, which is in course of construction at the Point of Ayr Colliery of the North Western Division of the National Coal Board, will be the first colliery generating station in the British Isles to use as prime movers dual-fuel engines running on methane gas obtained from the underground coal seams. It will also be one of the most efficient plants of its type due to the addition of waste heat recovery equipment in each of the five engine jacket cooling water and exhaust systems, the waste heat being stored to meet the colliery's varying requirements.

A small model of a non-linear electrical analyser for investigation of water flow in pipe networks was demonstrated by Mr. T. M. Prus-Chacinski. The apparatus comprises non-linear electrical resistor sets, each resistor set representing one branch of a network.

A further model which was on view demonstrated a technique for laying " repeatered " submarine telephone cable over the stern of a ship without the usual difficulties associated with the handling of the 11ft long 10 cwt repeaters. The scale is 1/24th full size, but the model does not truly represent an actual gear. In the absence of a pull overboard and for the sake of continuity the braking gear has been replaced by a driving mechanism.

Vee sheaves provide the means of control instead of a drum, enabling a restraint to be applied to, or removed from, the cable at will. A continuous smooth passage in any weather is ensured for the repeater by a duct and a launching cradle. The gear has been designed by Messrs. A. C. Hartley and R. J. Ashby in collaboration with Johnson & Phillips, Ltd.

VIEWS on the NEWS

By REFLECTOR

THE *Sunday Express* (never weary in well-doing) publishes an article calling attention to the vast sums spent on conferences of various kinds. The recent Power Convention gets special mention in the following terms:—

> "Eastbourne has just said *au revoir* to the 1,700 delegates attending the British Electrical Power Convention. And has doubtless urged the organizers to come back again. For it is reckoned that the electrical experts left behind in the town about £35,000."

Leaving aside the "reckoning," which reduces the number and probably exaggerates the expenditure, I challenge the suggestion made in the article that such conferences are merely expensive "sprees." Nobody will deny that there are extravagances here and there but they are insignificant against the closely-controlled expenditure of the majority of delegates who represent public bodies. And nobody who has considered the proceedings at the Power Convention will say that it was a time-wasting affair. The papers and discussions were of a high order, adding to knowledge and understanding, and the social contacts were most valuable for an industry whose sections are so closely allied. The real trouble is that everybody who would like to attend cannot do so and consequently Convention grapes are more than slightly acid.

* * *

Protests against the erection of overhead lines in this country are usually left to local authorities; in the United States individual private citizens sometimes take direct action. An illustrated note in the *Electrical World* (New York) states that "floral battle flags" were flown by Little Rock (Arkansas) residents in their fight against the erection by the Arkansas Power & Light Co. of a new high-voltage line.

> "When Arkansas P. & L.'s workmen arrived to put up the pole . . . the housewives refused to budge from perches on a cross-bar of the power pole. The women claim they'll sleep over the pole holes to stop pole setting. A.P. & L., however, says that work has not been held up."

* * *

One of its few hydro-electric stations has recently been closed down by the British Electricity Authority. Although its removal from the system will make a difference of only 25 kW, this station, at Kensham, nr. Bradninch, Devon, gave the village street lighting as long ago as 1909. In an article on the station and its attendant, Mr. L. Jeffrey, who is now retiring, in the South Western Electricity Board's magazine, Mr. E. F. Back says that:

> "consumers' supplies were not metered at Bradninch in the early days, a charge of 1s per lamp being made instead. This naturally produced a wonderful load factor, peak load being maintained throughout the 24-hour period."

* * *

For over two months the Electrical Trades Union has had over 400 of its members employed by J. Lyons & Co., Ltd., on strike because the company declines to force one of its supervising electricians to rejoin the Union of which he was once a member. This is an irritating kind of wrangle which brings the trade union movement into disrepute and there are signs that many of the men concerned realize it and would like to end the foolish business. It has now been reported that the teashops and other Lyons establishments in London are to be picketed in an endeavour to get people to boycott them. I think that the Union reaches the limit of ludicrousness when it attempts to secure public support for its action.

* * *

When the British Electricity Authority chooses a site for a new power station it is almost bound to offend somebody. All the suitable situations seem to be in beauty spots. Whether this can be said of the proposed South Denes station is perhaps open to question. My recollection of the Great Yarmouth area is not that it is one of particular scenic beauty or architectural merit, but probably the objection to the station expressed in its report by the Royal Fine Art Commission is based on other grounds. Nevertheless one can agree with the general principle enunciated by the Commission that bad siting cannot be remedied by "impressive elevations or elaborate brickwork." But of course there is room for difference of opinion as to what is a "good" and what is a "bad" site.

* * *

I see that the Nottingham and District Trades Council computes the cost of the British Electricity Authority's change of name as "up to £100,000," but I am at a loss to understand how this figure is arrived at. It was stated at a meeting of the Trades Council that alterations would have to be made to "stationery, building names—often inlaid or built in, in brass—a terrific fleet of lorries and upwards of 100 coastal ships." The Council passed a resolution asking the Government to bear in mind that the cost would fall on electricity consumers and urging the B.E.A. to reduce the expense to the minimum. Though the change is not due to take effect until next April I notice that the *Northern Echo* already refers to the "C.E.A. and Gas Board."

* * *

Looking through the *Electrical Review* of 6th July, 1894, my eye caught the following sarcastic note under the heading "Birmingham Saved from the Spoilers":—

> "The picturesque and classic streets of Birmingham have been saved from the hands of the spoilers. A Committee of the City Council will not permit the Central Tramways Company to erect the overhead system. In their own words, 'It was their duty to protect them [the streets] from the hopeless spoliation and disfigurement which acquiescence in the company's application would have involved.' We think this beats Glasgow's objection to the nude in art."

In the same issue some statistics of American power stations' coal consumption are reviewed. Three stations showed a consumption of 20 lb per i.h.p.-hour and many others reported between 10 and 20 lb. The majority had a consumption above 5 lb per h.p.-hour.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE period covered by the present appointments of some of the members of the National Research Development Corporation expired on 27th June. The President of the Board of Trade has reappointed **Sir Percy H. Mills,** Bt., K.B.E., as chairman and the following as members for a further period:—**Prof. P. M. S. Blackett,** F.R.S., M.A., **Sir John McL. Duncanson** and **Sir Edward de Stein. Sir Henry Hinchcliffe,** D.L., J.P., and **Sir Alan Saunders,** O.B.E., have been appointed in place of the retiring members, Sir Edward Hodgson, K.B.E., C.B., and Mr. W. E. P. Johnson, A.F.C., A.F.R.Ac.S., C.P.A.

Dr. S. Whitehead, director of the Electrical Research Association, has been elected chairman of the Committee of Directors of Research Associations.

Mr. V. C. H. Creer, M.A., director of the British Thomson-Houston Co., Ltd., has succeeded Mr. C. J. W. Scott as E.L.M.A. representative on the Electrical Fair Trading Council. He was recently elected chairman of the Association in the place of Mr. Scott.

Mr. W. H. Williams, a director of the General Electric Co., Ltd., and manager of the Osram Lamp Department, retired on 30th June but has agreed to be retained in an advisory capacity until 31st December. **Mr. A. E. Page,** who joined the company in 1915 and was appointed assistant manager of the Osram Lamp Department in 1930 and sales manager in 1946, has taken over the full management of the Department.

Mr. A. E. Page

At a dinner held at the B.E.A. South Wales Division headquarters presentations were made to **Mr. L. P. Morinan,** A.M.I.Mech.E., A.M.I.E.E., power station superintendent at Cardiff, who has retired after forty years' service.

Mr. T. A. St. Johnston, A.M.I.E.E., assistant works manager of the Micanite & Insulators Co., Ltd., who recently celebrated his 70th birthday, has retired after thirty-seven years with the company. He commenced his career with the British Thomson-Houston Co., Ltd., Rugby, in 1901, later joining West Ham Corporation and then St. Marylebone Electricity Supply. Mr. St. Johnston joined Micanite & Insulators in 1917. To mark their appreciation of his activities the Foremens' Association, the Long Service Association and M. & I. Sports recently made presentations to him. After a visit to South Africa, where he hopes to make many trips inland, Mr. St. Johnston plans to return to his farm in Essex. He is well known as a radio amateur, licensed since 1923, with the call sign of G6UT.

Mr. K. D. Hodgson, district engineer at Edinburgh for the South East Scotland Electricity Board, has been appointed deputy chief engineer for the Bermuda Electric Light Co. He received his early training with the Carlisle Corporation Electricity Department and held posts with the Huddersfield Corporation and the Yorkshire Electricity Board before obtaining his post at Edinburgh five years ago. Mr. Hodgson served with the Indian Engineers and Royal Engineers during the last war and became a staff captain (electrical and mechanical).

Mr. W. C. Bennett, purchasing manager of Standard Telephones & Cables, Ltd., New Southgate, retired at the end of last month after forty-four years' service. He joined the staff of the United River Plate Telephone Co. in 1910 as assistant buyer and later served as commercial manager. After some twenty years with this company he was transferred to Standard Telephones & Cables. His successor at New Southgate is **Mr. S. F. Monk.**

Mr. F. R. M. De Paula, C.B.E., F.C.A., has resigned his directorship of Electric & Musical Industries, Ltd., to facilitate the appointment of **Mr. J. F. Lockwood,** who has accepted a seat on the board. Mr. Lockwood is chairman and managing director of Henry Simon, Ltd., and is a director of the National Research Development Corporation.

Mr. G. E. Collier, A.M.I.E.E., A.I.I.A., A.M.I.B.Ag.E., has been appointed commercial officer of the North of Scotland Hydro-Electric Board's North Caledonia Area. Mr. Collier, who entered the supply industry in 1929, has served successively in the commercial departments of the Edinburgh, Stafford and Norwich Corporations and the Norfolk Sub-Area of the Eastern Electricity Board. He received his technical training at the Heriot-Watt College, Edinburgh.

The annual golf tournament of the **Aluminium Development Association** was held at the Wentworth Club, Virginia Water, on 24th June, foundry members of the Association acting as hosts. At a dinner following the tournament the president of the Association, Mr. R. T. Prie man, touched briefly upon the value o the aluminium industry of its me bers meeting together on such occasio s.

Mr. O. G. Cox, previously n an executive position in the I essey Company's Components Divis n at Ilford, has been appointed g neral manager f a new divisi n of the compa y, to be known the Swindon Components Di ision and respo sible for the dev lop-ment, ma ufac-ture and sa e of electrolytic and paper capa itors and mo lded track potentiometers. Mr. Cox will operate from Kembrey Street, Swindon, where the new division's activities, under existing management, are now concentrated.

Mr. O. G. Cox

Over 10,000 people attended the sports and gala day of the **Metropolitan-Vickers Electrical Co., Ltd.,** on 19th June, among whom were Dr. C. Dannatt, deputy managing director, and other directors and senior officials. The athletic prizes were presented by Mrs. Dannatt and the prizes for the novelty and children's events by Mrs. A. C. Main, wife of the director of manufacture. Held for the first time in the Metropolitan-Vickers Apprentices Training School grounds alongside the Trafford Park works and graced with fine weather, the occasion provided an afternoon and evening for the family and included sideshows organized by various clubs and societies. The entrants for the athletic events totalled over 400 and the events open to all companies of the A.E.I. group were as usual well patronized.

The annual sports day and gala of **Siemens Brothers & Co., Ltd.,** was held on 19th June at the company's sports ground, Charlton. Included in the events were the Kent County A.A.A. Youth Championships. Lady Morgan, wife of General Sir W. D. Morgan (chairman of the company), presented the prizes.

The summer school on welding organized by the **British Welding Research Association** was held at Ashorne Hill, near Leamington Spa, from 14th to 19th June last. The theme was "Welding Design and Practice" and a general plan was

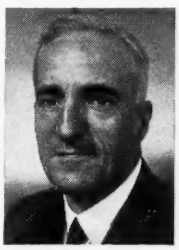
followed of giving lectures of general interest in the mornings with lectures of more specialized interest to smaller groups in the afternoons. The 170 students who attended the school were divided into groups to meet as far as possible their individual requirements. To supplement the lectures some practical demonstrations of welding and cutting processes were organized with the collaboration of some of the leading industrial exponents of the various methods and equipments involved.

The annual sports and gala day of **Johnson & Phillips, Ltd.,** was held at the company's sports ground at Kidbrooke on 26th June. The events were keenly contested and there were some good performances. The sideshows were well patronized. Following the events the prizes were distributed by Mrs. D. Rodger, widow of the late Mr. J. G. Rodger, who was assistant general manager (commercial).

The area final of the Norfolk and Suffolk Area of the **E.I.B.A. National Golf Championship** will be held at Thetford Golf Club, Norfolk, on 14th July. Further particulars can be obtained from Mr. D. C. Mason, "Bradford," Harold Road, Frinton-on-Sea, Essex.

OBITUARY

Mr. L. R. Nixon.—The death occurred on 19th June of Mr. Leslie R. Nixon, M.Sc.(Eng.), M.I.E.E., M.I.Mech.E., chief of research and development, J. Stone & Co. (Deptford), Ltd. Born in London in 1900, he was educated at University College, London, and received his technical training with the British Thomson-Houston Co., Ltd., Rugby. From 1923 to 1929 he served as designer, machines, to the B.T.H. Co., and for the next three years he was designer, wireless transmitters, to Marconi's Wireless Telegraph Co., Ltd. He then joined J. Stone & Co., Ltd., as chief designer, a position he held until becoming chief of research and development in 1951.



The late Mr. L. R. Nixon

Mr. O. J. R. Howarth.—The death occurred on 22nd June, at the age of seventy-six, of Mr. Osbert J. R. Howarth, who was secretary of the British Association for the Advancement of Science for many years until his retirement in 1946.

Mr. William Edward Beck Dove, managing director of Dove & Partners, electrical contractors, Darlington, died on 20th June at the age of seventy-eight. Mr. Dove started business fifty years ago and was responsible for bringing the first supply of electricity to Darlington.

Mr. Donald John Bennett, the younger son of Mr. H. G. Bennett, a director of the Trafalgar Engineering Co., Ltd., Deptford, was killed in a flying accident at Elmdon Airport, Birmingham, on 24th June. The late Mr. Bennett was also a director of the Trafalgar Engineering Co. and of the Gothic Engineering Co., Birmingham. A memorial service is to be held in London at a date to be announced.

Mr. Francis Morley Colebrook, senior principal scientific officer at the National Physical Laboratory at Teddington, head of the team which built the automatic calculator ("electronic brain"), died at Hillingdon on 21st June at the age of sixty-one. Mr. Colebrook studied at London University and the City and Guilds of London Institute and before becoming head of his own section at the N.P.L. was deputy to Dr. Smith-Rose, the head of the radio division. He wrote many papers and books and was a member of the honorary Editorial Advisory Board of the "Wireless Engineer."

Mr. H. D. Wilson, a director of the Sifam Electrical Instrument Co., Ltd., has died. He had been associated with the company for the past sixteen years, first as technical sales engineer.

Mr. G. Robertson.—The death has occurred at Keswick (Cumberland) of Mr. George Robertson, former superintendent of South Shields power station. He was eighty-four years of age and before his retirement in 1935 had been superintendent for forty years.

Mr. John Leonard Eve, chairman and managing director of the J. L. Eve Construction Co., Ltd., died on 25th June.

Mr. Frank Hulme, managing director of F. Hulme & Co., Ltd., Manchester, died on 23rd June.

I.E.E. Premiums

THE Council of the Institution of Electrical Engineers has made the following awards of premiums for papers read or accepted for publication during the 1953–54 session:—

Group A.—*Institution Premium:* P. M. Hollingsworth, M.Eng., and P. A. Raine. *Kelvin Premium:* H. Diggle, B.Sc.Tech., and E. R. Harthill, B.Sc.(Eng.). *John Hopkinson Premium:* D. P. Sayers, B.Sc., M. E. Laborde, Ing. E.S.E., L.'es.Sc., and F. J. Lane, O.B.E., M.Sc.

Group B.—Non-Section Premiums. *Ayrton Premium:* R. J. Halsey, B.Sc. (Eng.), F. C. Wright, A. H. Roche, B.Sc.(Eng.), F. O. Roe, B.Eng., D. C. Walker, B.Sc.(Eng.), and J. F. P. Thomas, B.Sc.(Eng.). *Llewellyn B. Atkinson Premium:* C. W. Miller, M.Sc. *Extra Premium:* A. Fairweather, Ph.D., M.Sc.

Measurements Section. — *Silvanus Thompson Premium:* K. J. R. Wilkinson, D.Sc., and J. D. Harmer, B.Sc. *Mather Premium:* P. J. Palmer, M.Sc. *Extra Premiums:* K. Kandiah, M.A.; H. McG. Ross, M.A.; C. W. Oatley, M.A., M.Sc., and J. G. Yates, M.A.; and A. G. Milnes, M.Sc.

Radio Section.—*Duddell Premium:* G. W. Barnes, B.Sc. *Ambrose Fleming Premium:* M. M. Z. Kharadly, B.Sc., Ph.D., and Willis Jackson, D.Sc., D.Phil., F.R.S. *Extra Premiums:* A. L. Cullen, Ph.D., B.Sc.; E. D. Daniel, M.A., and P. E. Axon, O.B.E., M.Sc., Ph.D.; E. A. O'Donnell Roberts, M.Sc., Ph.D.; J. A. Saxton, D.Sc., Ph.D.; and B. N. Harden, M.Sc.; J. Brown, M.A.; A. Talbot, M.A., Ph.D.; and E. Green, M.Sc.

Supply Section.—*Sebastian de Ferranti Premium:* J. S. Forrest, M.A., D.Sc., and J. M. Ward, B.Sc. *John Snell Premium:* Y. K. Ching, B.Sc., and B. Adkins, M.A. *Extra Premiums:* B. C. Robinson, M.Sc., Ph.D.; N. Troost, B.Sc.(Eng.); and F. H. S. Brown, B.Sc.

Utilization Section.—*Swan Premium:* C. G. L. Morley. *Extra Premium:* R. F. Sims, B.Sc.(Eng.).

Group C.—*Blumlein-Browne-Willans Premium:* G. Dawson, B.Sc., L. L. Hall, K. G. Hodgson, B.A., R. A. Meers, O.B.E., T.D., and J. H. H. Merriman, M.Sc. *Fahie Premium:* T. Hayton, B.Sc., C. J. Hughes, B.Sc., and R. L. Saunders, B.Sc.(Eng.). *Heaviside Premium:* J. F. Coales, O.B.E., M.A. *Paris Exhibition* (1881) *Premium:* M. Garreau and F. Nouvion. *Oversea Premium for Senior Members:* Professor K. Aston, M.Sc., and Professor M. V. Kesavarao. *Oversea Premium for Students and Graduates under 28 years of age:* S. Kaneff, B.E.

Students' Premiums.—*Premiums of the value of £10 each:* M. H. Alder, B.Sc.(Eng.); E. P. Fowler, B.A.; and W. D. Jackson, B.Sc. *Premiums to the value of £5 each:* P. J. Bhatt, B.Sc. (Eng.); A. W. Hales; R. A. Hore, B.Sc., B.A.; Sub-Lieut. R. E. James (L), R.N., B.Sc.(Eng.); D. Legg, B.Sc.; A. B. J. Reece, M.Sc.; and Margaret K. Weston, B.Sc.(Eng.).

Public Transport Association

The annual dinner of the Public Transport Association is to be held at Grosvenor House, Park Lane, London, W.1, on 11th November. It is expected that the Minister of Transport, the Rt. Hon. A. T. Lennox-Boyd, M.P., will be the principal guest.

PARLIAMENTARY REPORT

IN the House of Commons last week Mr. Hobson asked the President of the Board of Trade if he was aware that foreign radio valves were being imported into this country, clearly marked " Foreign Made," but bearing the stamp of a prominent British manufacturer and the stamp of the British Valve Manufacturers' Association; and what steps he proposed to stop this abuse.

Mr. Henry Strauss said that Section 16 of the Merchandise Marks Act, 1887, required that such goods imported into the United Kingdom should be accompanied by a definite indication of the country in which the goods were made. A " Notice to Importers " issued jointly by the Board of Trade and the Commissioners of Customs and Excise and in use since 1927 treated the marking described in the question as sufficient compliance with this requirement.

Mr. Hobson asked for the number of firms which had been granted licences to import radio valves since October, 1953.

Mr. Strauss said that any firm might import radio valves originating in and consigned from Western Europe and certain other countries under the open general licence without further specific authority. For radio valves not covered by the open general licence, individual licences had been issued to thirty-seven firms during the period 1st October, 1953, to 15th June, 1954.

Asked what was the number of radio valves imported into Great Britain during the first quarter of this year, Mr. Strauss said that radio valves were not separately recorded but 2,078,000 electronic valves were imported into the United Kingdom in the first quarter of this year, and 771,000 in the corresponding quarter last year. He agreed that it was a big increase, but there was a key duty of 33⅓ per cent on these imports.

Mr. Gaitskell asked, in view of the fact that the increase was threefold, if Mr. Strauss could give an explanation of how this had happened.

Mr. Strauss said he was not sure that this was a complete explanation but it might be the very large increase in the demand for television sets.

Welsh Rural Electricity

Mr. Tudor Watkins raised the subject of capital contributions towards rural electrical development schemes especially in South Wales.

Mr. Joynson-Hicks, Parliamentary Secretary to the Ministry of Fuel and Power, said that until 1952 the old system which operated before nationalization was continued so that the Board could thoroughly investigate the needs of the locality. That was why only comparatively recently had the change taken place. What was happening was that the Electricity Boards were in one way or another recouping the cost of what they were supplying. On 19th June last year the Minister made an appeal to the industry to ensure that it did not rely solely on one method of charging in order to meet the capital cost, but offered alternatives. He was very glad to say that the industry had responded to the appeal and that all the Boards now offered one or more alternatives.

Mr. Watkins's difficulty was due to the fact that his constituents were far too conservative-minded, at any rate in their use of electricity. It was a remarkable thing that the people of South Wales, when they had electricity, used it in such small quantities that it was very difficult for the Board to obtain an adequate revenue on the service it supplied. Progress was certainly taking place in South Wales generally. The B.E.A. had its main 132 kV line energized from Carmarthen to Carmarthen Bay since December last. The extension of the line from Carmarthen to Haverfordwest would be energized next month. The capital expenditure authorized last year enabled the Board to do its work in parallel with the extensions of the h.v. lines which were being carried out by the Authority. Consequently, although in 1952–53 it was possible to take electricity to only 396 farms, in 1953–54 the number jumped to 955. In the current year, 1954–55, it was estimated that the number would be more than 1,000. In Brecon and Radnor the Board was developing with great rapidity a 66 kV line, which was completed last winter from Abergavenny up to Brecon, and development was now taking place there. By next winter an extension would have been completed from Brecon to Builth Wells. That again would make possible far more rapid development towards the South.

District Heating Schemes

Mr. Palmer asked the Minister if he would state the number and location of new district heating schemes planned in conjunction with electric power developments.

Mr. Lloyd said there were three—at Spondon, Warrington and Stepney.

Mr. Palmer asked if the Minister would discuss the possibility of providing special financial assistance beyond the resources of the electricity industry.

Mr. Lloyd said it was much better that this matter should proceed, as at present, on the basis of proper commercial negotiations.

Cross-Channel Cable

Mr. Janner asked the Minister of Fuel and Power what was the present position with regard to the experimental arrangements for linking the power system of Great Britain with Western Europe by means of a cross-Channel power cable; and what consideration had been given by his Department to the construction of a tunnel under the Channel for this purpose which would serve to carry the necessary cables as well as provide a pilot road and rail tunnel.

Mr. Geoffrey Lloyd said that the proposals which he had approved were for experiments in regard to a scheme for laying submarine cables and transmitting electric power across the Channel. No proposals had been made to him for the construction of a tunnel. Cable-laying trials were conducted off the English coast last summer, and the corresponding sea trials by the French authorities were now in progress at Boulogne.

Atomic Power

Mr. Ellis Smith asked the Minister of Fuel and Power if he was satisfied that good co-operation had been arranged between the Ministries affected, the B.E.A., the Atomic Energy Authority and manufacturers so that the generation of electricity could be obtained from nuclear energy as soon as possible and contracts undertaken for plant for other countries.

Mr. Palmer asked the Minister what was the nature and method of the co-operation to be established between the B.E.A. and the proposed Atomic Energy Authority.

Mr. Lloyd said that co-operation was already close and continuous in all matters affecting the generation of electricity.

Mr. Palmer asked the Minister if his departmental advisers now included those versed in the problems and possibilities of nuclear science.

Mr. Lloyd replied in the affirmative.

Safety in Substations

Mr. Irvine asked the Minister whether he would, within the powers conferred upon him by Section 5 of the Electricity Act, 1947, give a general direction to the Central Authority to ensure that greater safety precautions were to be taken in substations.

Mr. Lloyd replied in the negative. He said that Section 53 was the relevant section.

Mr. Irvine asked if the Minister was aware that the machinery of joint consultation appeared to be breaking down, and that recommendations arising out of an accident at Bishopsgate, which nearly resulted in serious loss of life, had been made and accepted but not implemented by those responsible.

Mr. Lloyd said that the Act passed by the previous Government clearly laid it down in Section 53 that this was one of the matters which should be dealt with by joint consultation, and he would not like to assume, simply on what Mr. Irvine had said, that that consultation had broken down.

Mr. Shinwell asked if the Minister had had any complaints from either side about the lack of consultation in respect of this particular section of the Act.

Mr. Lloyd: So far as I am aware, none.

INDUSTRY AND THE HOUSE

Anxiety About Coal Supplies

By A. M. F. PALMER, A.M.I.E.E., M.P.

Fuel and power is likely to achieve prominence once again in the Parliamentary scene as a result, among other things, of the questions put last Monday to the Minister, Mr. Geoffrey Lloyd, by a number of Members on the coal prospects for next winter.

Mr. Lloyd stated that coal consumption compared with last year had been greater by three million tons and production by one million tons. Exports and bunkers had remained the same and total distributed and undistributed stocks were now 1½ million tons less. The Government had been carefully considering the prospects for next winter and as a result he had already authorized the import of more coal from abroad. In answer to an inquiry, Mr. Lloyd said that he was satisfied that this action would be likely to meet all the contingencies of next winter, including the risk of a spell of bad weather.

It is well known that Mr. Lloyd when he comes to the dispatch box these days fears not only the shot and shell of his official Parliamentary enemies, but the barbs of his friends behind as well. The ever-restless Mr. Nabarro, Conservative Member for Kidderminster, is the ringleader of the fuel and power Conservative "rebels" and others are to be found perhaps among the group responsible for the recent pamphlet "Change is our Ally." Certainly these Members have a serious concern for the coal situation, which is going to be difficult enough in all truth next winter, but they also nourish an inborn dislike of nationalization, combining this dislike with a contradictory urge for a "planned" fuel policy which in practice would probably mean clipping the wings so recently given back to electricity supply.

"Dangerous" Fuel Situation

More of this Conservative back bench campaign against present policies will be heard yet, and Mr. Nabarro's supplementary last Monday was a first taste of things to come. He asked if the Minister's attention had been drawn to the recent speech by Mr. Arthur Horner, general secretary of the National Union of Mineworkers, to the effect that the coal situation was now the most dangerous since 1946, and whether the measures for importing additional coal would meet the situation without cutting vital exports still further.

Mr. Lloyd said that earlier in the year the National Union of Mineworkers had assured the Coal Board that they would regard 2½ per cent increase of output this year as the minimum standard at which to aim. So far there had been no increase in output except for the extra million tons which resulted from there being no special Coronation holiday. The miners' leaders had been making helpful speeches in the coalfields in order to assist him; he looked on Mr. Horner's as one such speech. Open Conservative scepticism at this and other stone-walling by the Minister in the end brought Mr. Blyton, miners' Member from Houghton-le-Spring, to his feet to protest at what he called "sniping at the miners" by Government supporters. Mr. Blyton thought it would not help to get the extra coal needed. Mr. Lloyd was sharp in his reply; he took pains to distinguish between "responsible" and "irresponsible" Conservative supporters. The battle is evidently now on.

Television Bill's Third Reading

The Television Bill, which had become something of a Parliamentary bore, has now departed from our midst for the "Other Place"; few would be found to say they honestly regretted its going. Mr. Gammans, the Assistant Postmaster General, in moving the Third Reading, proclaimed it was generally agreed that there ought to be a second television programme. To end the B.B.C. monopoly was the whole purpose of the measure; nothing in it would in any way hold up the proper development of B.B.C. services. There was nothing, for instance, to preclude the B.B.C. from producing a second television programme if it wished to do so, but the Corporation had made it clear that it could not hope to start on this before 1957. Independent television, on the other hand, would be on the air next year.

A Conservative Government, said Mr. Gammans, could not accept the view that advertisements were bad in themselves and must inevitably raise the price of goods; advertisements which were acceptable on hoardings and in newspapers did not become automatically dangerous if they appeared on a television screen.

In turn Members on both sides who had borne the heat and burden of the day in Committee discussions said their last farewell. Mr. Mayhew, Labour Member for Woolwich East and a bright television star himself, contended again that the Bill had been introduced under the pressure of "vested interest"; it had no support from public opinion, it had never been before the country at an election, it had been steam-rollered through the House, strongly and steadfastly pushed on by honourable Members who had frankly declared a financial connection.

In answer to this Mr. Ian Harvey, who sits as a Conservative for Harrow East, denied strongly that the movement for commercial television originated among advertisers. Having been present at many of the discussions in the Conservative Party on the subject, he could say the outstanding demand had been for a breaking of the B.B.C. monopoly. As practical people they had realized that it could only be done effectively by calling in commercial assistance.

Winding up for the Opposition Mr. Gordon Walker suggested that a radical change had been made by the acceptance of an amendment which permitted special charges to be made for special programmes. This had opened the door wide to sponsorship which had been admitted with "appalling frankness" by the Assistant Postmaster General. To allow special charges for special programmes would give advertisers direct control and influence over programmes. Having the last word, Sir David Maxwell Fyfe, the Home Secretary, denied that the Government was going back to sponsoring and maintained that the programme companies and not the advertisers would choose the programmes. In general the Bill was

" a great step forward in Britain's history." Amid loud Ministerial cheers the Bill was read a third time by 229 votes to 265—a majority of 26.

There have been inquiries from the Labour Opposition about the methods used to sell off the various steel concerns under the de-nationalization arrangements. On Tuesday Mr. George Strauss, Labour's former Minister of Supply, asked the Chancellor of the Exchequer whether he endorsed the terms of the sale of the English Steel Corporation shares to Vickers and Cammell Laird. The essentials of the transaction were that the previous owners had bought back for half the price at which they sold the full control of the English Steel Corporation and an entitlement to six-sevenths of all the profits the company made.

In answer Mr. Butler, the Chancellor of the Exchequer, stated that while it was true that the equity was sold for £10 million, there were considerable prior charges still remaining to be disposed of and it was the wish and intention of the Realization Agency to deal with them as well. Mr. Gaitskell asked if the Chancellor of the Exchequer denied the statement of facts given by Mr. Strauss. Mr. Butler answered that the full picture was to be found in the public prospectus. The steel companies had to be sold on the market. Various sales had been made, some of which showed a good profit and others which did not show so much profit; he thought the Government had achieved a reasonable balance in making the sales, as would be shown when the transactions were finally closed.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Optimum Load

MANY will be concerned, as I am, at the statement in your issue of 25th June arising out of a question to the " Electrical Forum " at Eastbourne that " not all are aware that there is a fairly low level to which it is desirable to limit load factor."

Whilst a load factor on the national supply of 60 per cent may be the highest that is likely to be achieved within the immediate future, it is surely quite wrong that such a low figure of load factor should be accepted as the optimum. If spare plant amounting to 10 or 15 per cent in excess of the maximum system load, plus the breakdown margin, were to be provided eventually, not only would it be possible to carry out routine overhauls throughout the year with a consequent saving of overtime charges, but it would be possible also for the generating stations to carry a system load with a load factor approaching 100 per cent, which would reduce the fixed generation cost per kWh by about a half. The effect of having to run the less efficient plant for longer periods could hardly offset this substantial saving.

The economic advantages of a load factor approaching 100 per cent on the transmission and distribution systems would be even more marked than in the case of generation, as the system efficiency would be improved rather than reduced by higher load factor.

Though the attainable in load factor may be rather less than the optimum, let us not fix our sights too low.

" LOAD FACTOR."

Interference in the Isle of Man

REFERRING to " Reflector's " recent note and Mr. L. Douglass's letter in your issue of 11th June, while I am in no position to judge whether the severe electrical interference with radio and television reception caused by the Isle of Man Electricity Board in Laxey and many other parts of the Island, is caused by overloaded substation transformers or bad regulation on the entire distribution system, I am certainly in a position to say categorically that this interference will not be cured by " a little more signal strength."

I would like to refer Mr. Douglass to the B.B.C.'s report on this matter wherein they state that it would be necessary to install a B.B.C. transmitter in every back garden to overcome the severe electrical interference. In my own particular case, I have a television signal input of 1·6 millivolts per metre. This signal is by no means strong enough to overcome the e.h.v. power line interference.

I cannot agree with Mr. Douglass's assertion that the Electricity Board is small and efficient. In fact, Mr. Douglass might be well advised to keep off this subject when one remembers that the Island, of 50,000 inhabitants, is being served by two electricity undertakings, each of them capable of supplying double the possible requirements.

Douglas, I.O.M. T. H. COLEBOURN, A.M.Brit.I.R.E.

Domestic Heating

IN the article by Mr. A. C. Hazel, on page 1109 of your 11th June issue, the first consideration should have been to provide at least 1,000 cu ft of air per hour per person. Some authorities state higher than 1,000.

Regarding his mention of closing the chimney, etc., that should only be done if air conditioning is installed.

Inverness. H. K. WHITEHORN.

I APPRECIATE Mr. Buckle's letter agreeing with my points and I thought his method of describing his own heating installation quite a useful way of indicating how well electricity can be used. Perhaps it might be beneficial if various people described their own methods of heating and gave their running costs.

The only point on which we differ is that I maintain it is to the advantage of the electricity supply industry to allow solid fuel to carry a part of the main winter space and water heating load as recommended by the Ridley Committee. Indeed, Mr. Bellamy in his paper and many other speakers at the Eastbourne Power Convention took this same line.

In a cottage in the country I use a domestic boiler of 45,000 B.Th.U. rating and this heats five radiators and provides sufficient hot water for a family of four in which all the clothes washing is done electrically. Three bedrooms are heated in the winter by oil filled electric radiators under separate air thermostat and time switch control

from 7 p.m. to 10 p.m. In the spring and autumn and cold summer days, oil filled electric radiators are used to provide background warmth in the kitchen when the electric immersion heater has taken the place of the boiler, and in the lounge, hall and bedrooms.

The house has a great many electrical appliances, including a cooker and deep freeze, but no radiant electric fires, due to the fact that there is a small child.

My electricity bill in the winter months never averages more than £1 per week where the average price of electricity is 1d, and the amount of " Coalite " used averages about ½ cwt a week. It will thus be seen that the combination of electricity and solid fuel can be cheaper than using nothing but electricity.

However, I completely agree that there is a case for all-electric heating and in a small two-room town flat with bathroom and kitchenette, where oil filled electric radiators are used exclusively for heating, the electricity bill averages about 10s per week for a five day week.

*London, W.*1. A. C. HAZEL.

Round- and Flat-Pin Plugs

THE final words in the leaderette under the above heading in your issue dated 25th June—" we are not so sure, however, that the average user is very much bewildered about it all "—hit the target.

The old controversy is a thing of the past. Twenty to twenty-five years ago we were in a state of flux; there were numerous three-pin plugs on the market—some conforming to the then recently published B.S. 546 and some not.

To-day we have the round pin specification 546 and the rectangular pin specification 1363. Each has its uses and each is rapidly finding its own level—these to the exclusion of all other types.

*Edmonton, N.*8. C. L. ARNOLD,
M.K. Electric.

Lampholder Troubles

REFERRING to the letter published under the above heading in your issue of 4th June we would say that if Mr. W. V. Barnett would like to get into touch with us we could offer him lampholders with the coarse thread which he mentions. These, we can assure him, will prevent binding of the shade carrier on the thread.

Inevitably the price of such a lampholder is, in view of its special nature, higher than that of the more ordinary one of moulded construction.

Manchester. NETTLE ACCESSORIES, LTD.,
D. REVINGTON,
Managing Director.

FOR years the lampholder has been the chopping block of the electrical trade and the demand has always been for cheaper holders irrespective of quality. Something has had to be sacrificed to meet this demand so mouldings and liners have been cut to the absolute minimum; hence Mr. Barnett's experience of the lamp coming away from the inner brass lining.

A moulded lampholder with a substantial liner, keyed top and bottom, into a thick moulded wall and extended well down into the body of the holder will stand up to prolonged use. The very fact that the brass liner is actually under the threads prevents cracking and the key stops it from falling out. There is no reason why a well-made moulded holder should give trouble and well-made moulded holders can be bought for very little extra cost.

*London, W.*1. J. A. C. KENDLE.
Sales Manager, Wiring Accessories Dept.,
Edison Swan Electric Co., Ltd.

BRITISH I.R.E. CONVENTION

MORE than 300 delegates representing nine industries and from many parts of the world are to discuss industrial electronics at the third post-war Convention of the British Institution of Radio Engineers at Christ Church, Oxford, from 8th to 12th July. Among the countries represented will be Canada, Australia, India, Pakistan, Eire, France, Holland and the U.S.A. A distinguished visitor contributing to the discussions will be Dr. Mervin Kelly, head of the Bell Telephone Laboratories, U.S.A.

Some 38 papers will be discussed, all of them dealing with the application of electronics to industry. Among the subjects are computers for office and factory, ultrasonics, industrial X-rays, nucleonic instruments, gauge transducers, engine testing and machinery control.

The opening address will be given by the president, Mr. W. E. Miller, at Christ Church at 2.30 p.m. on 8th July and at 8 p.m. on the same evening, in the Clarendon Laboratory, Sir John Cockcroft will deliver the Institution's second Clerk Maxwell Memorial Lecture. The final session and summing up will be on Sunday at 5.30 p.m. when there will be a debate on " Electronics is the key to improving and increasing production in Great Britain," the chair to be taken by Sir Walter Puckey.

RHODESIAN POWER SCHEMES

THE Salisbury (Southern Rhodesia) correspondent of *The Times* reported on Monday last that consultants from Electricité de France had been asked by the Federal Government to advise it whether the Kariba or Kafue hydro-electric schemes should be proceeded with first. New calculations indicated that the potential of the Kafue scheme might be greater than the original estimate but at a higher capital cost. The cost of the Kariba project might be lower than originally estimated and the period of construction shorter. The dates on which power could be made available were not very different for either scheme.

The Federal Hydro-Electric Board for Rhodesia and Nyasaland held its inaugural meeting last week. The interim chairman is Mr. J. H. Lascelles and the members include Mr. A. B. Cowan, chairman of the Southern Rhodesian Electricity Supply Commission.

NATIONAL REGISTER MEETING

ON Monday the National Register of Electrical Installation Contractors held its annual general meeting at the Institution of Electrical Engineers, London. Mr. E. A. Mills took the chair in the absence of Mr. P. V. Hunter, who was indisposed. In the report presented by the Registration Board it was stated there were 879 names on the Register at 31st December last. Fourteen new certificates were issued during the year and there were six reinstatements; forty-four names were deleted from the Register, twenty-five due to resignation and failure to renew registration. During the year 417 inspections were carried out involving the examination of 847 installations of all descriptions. The subject of earthing, particularly in rural areas, was given considerable attention. Commenting on the report, Mr. R. Birt drew attention to the fact that Mr. Hunter had been chairman of the Register for nearly thirty years.

SIR CHARLES PARSONS CENTENARY

THE centenary of the birth of Sir Charles Parsons is being commemorated at the Science Museum, South Kensington, for about three months by a special display in the East Hall. Sir Charles Parsons' original 7½ kW high-speed steam turbo-generator of 1884 is exhibited by the side of a scale model, one sixteenth full-size, of a modern Parsons 50,000 kW steam turbo-alternator. Photographs show other important developments in mechanical, electrical and marine engineering and in the optical industry, due to his pioneer researches and inventions. The attention of visitors is also drawn to numerous other examples of the work of Sir Charles Parsons exhibited in various galleries of the Museum.

INDUSTRIAL NEWS

Lyons Electricians' Strike

REPRESENTATIVES of the Electrical Trades Union and of J. Lyons & Co., Ltd., met on 22nd June in an endeavour to settle the two months' old strike of electricians at the company's Greenford, Cadby Hall and other establishments. Although later it was stated that both sides had agreed in principle to the submission of the dispute to arbitration the company insisted that the non-E.T.U. supervisor over whom the strike occurred should remain at work at Greenford. It also required that the terms of submission of the case to an arbitration tribunal should be that the company was free to transfer any supervisor to any of its establishments whether he was a member of a union or not. The Union maintained that its members should be free to decide whether or not to work with a particular supervisor.

On 23rd June about twenty electricians employed by the Norman Garage Co., a Lyons subsidiary, were ordered to strike, raising the number of men involved to about 470.

The continuance of the strike was considered at a meeting called by the E.T.U. on Friday last. Although there were some objections to the extension of the strike the meeting, by a large majority, left the matter in the hands of the Union's executive. It was stated afterwards by a spokesman of dissentient members that although they had made no protest at the meeting they intended to continue to oppose the strike.

Middlesbrough Wiring Contract

Middlesbrough Estate and Development Committee proposes to renew the electrical installation at the Municipal Buildings at a cost of £11,500. Last week the Committee approved a list of ten electrical contractors whom the consultant suggested should be invited to submit tenders for the job. The names of two local contractors added to the list by the borough engineer, Mr. J. A. Kenyon, were deleted, after it was explained they were the only two who were not members of the Electrical Contractors' Association, and, therefore, unable to offer the guarantee that went with membership of that organization. The Committee decided to defer its decision on whether the lowest tender should be accepted. The chairman (Councillor F. Manton) commented that the Committee should retain control of the contract for as long as possible. Not only was a satisfactory price wanted, but the Committee had to be sure the contractor selected would be able to carry out the work with the least inconvenience to staff and in as short a time as possible.

Next Week's Events

Events which take place next week include the Royal Show which opens at Windsor on Tuesday and continues until Friday. From Thursday to the following Monday a Convention on Industrial Electronics is being held by the British Institution of Radio Engineers at Christ Church, Oxford. The Laundry, Dry Cleaning and Allied Trades Exhibition, which is being held at Olympia, London, from 8th to 17th July, will include exhibits of electrical interest.

Sheep Shearing Fatalities

At a Ramsgate inquest on two men who died from electric shock while shearing sheep at Minster, Thanet, Mr. A. R. R. Terry, assistant district consumers' engineer, South Eastern Electricity Board, stressed the importance of having someone with proper training, experience and technical knowledge for installing electrical equipment. He advocated the use of low voltage, specially designed tools with wander-leads for "earthy" situations and said that, in this particular case, he would have liked to have worked on a wooden platform. When the coroner asked if any publication, in simple language, was issued for the guidance of the public, Mr. Terry said that the public should not be expected to do work of this nature. Recording a verdict of "Accidental death," the coroner said that either the earth wire had been connected to the wrong terminal in the fuse box, or that terminal might not have acted as an earth terminal.

A high voltage transformer constructed in Great Britain for the United States arrives on the site at the Folsom Dam, California. The contract was placed with the English Electric Co., Ltd., by the United States Bureau of Reclamation

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton	£156 0s 0d
COPPER, H.C. Electro	ton	£239 0s 0d
Fire Refined 99·70%	ton	£238 0s 0d
Fire Refined 99·50%	ton	£237 0s 0d
COPPER Tubes	lb	2s 3¼d
Sheet	ton	£299 15s 0d
H.C. wire and strip	ton	£266 10s 0d
LEAD, English	ton	£97 5s 0d
Foreign	ton	£96 0s 0d
MERCURY	flask	£95 0s 0d
TIN, block (English)	ton	£744 0s 0d
ZINC, G.O.B. Foreign	ton	£77 15s 0d
Electrolytic	ton	£87 0s 0d
BRASS Tubes (solid drawn)	lb	1s 10¾d
Sheet	ton	£245 10s 0d
Wire	lb	2s 6¼d
PHOSPHOR BRONZE Wire	lb	3s 9¾d
PLATINUM	oz	£30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb	20d–20¼d

U.S. Dam Contracts

Contracts for two water generators at Chief Joseph dam and two fish channel generators at the Dalles dam, both on the Columbia River on the Oregon border, have been awarded to an American firm, the Westinghouse Electric, in spite of a lower bid in both cases by English Electric Co., Ltd. For the Chief Joseph Dam contract the English Electric bid was $1,842,914 against $2,083,301 by the Westinghouse Company. The decision was made by the Minister of Defence, Mr. Wilson, the British bids being rejected under the "Buy America" Act.

Mr. D. Bellamy's Paper

We regret that in our abstract of Mr. D. Bellamy's British Electrical Power Convention paper (*Electrical Review*, 18th June) we repeated a misprint which occurred in page 10. The reduction in the overall cost per kWh resulting from a 10·8 per cent improvement in load factor is 0·231d not 0·321d. In the report of the discussion on the paper the contribution made by Mr. A. C. Hazel was wrongly attributed to Mr. S. W. Hazell.

British Radio Link for Canada

Microwave radio relay equipment to carry television programmes in Canada between London and Windsor, Ontario, is to be supplied by the General Electric Co., Ltd., of England. The order has been obtained by the Canadian General Electric Co., Ltd., the main contractor for the scheme, jointly

from Canadian National Telegraphs and Canadian Pacific Telegraphs.

The link, which will employ similar equipment to that used on the Swiss Eurovision link supplied by the G.E.C., will incorporate four relay stations. It will carry 525-line pictures in black and white, or in colour. The installation is to be carried out in three stages: a one-way link, a second link in parallel which is reversible, and the conversion of the first link into a reversible system.

Tennis Floodlighting

The first of what it is hoped will be a number of new tennis floodlighting installations has been completed at Paddington Bowling and Sports Club. Floodlit tennis is already well established in many other countries, particularly in the U.S.A. and Australia. In Sydney alone there are said to be over 1,200 courts.

Designed by B.T.H. lighting engineers the installation at Paddington consists of ten "Mazda 9" projectors housing 1,000 W g.e.s. lamps. The fittings were specially made to throw light evenly over a controlled area. By mounting them in parallel lines on steel poles on each side of the court at 23ft centres and a height of 20ft, it has been possible to overlap the light projected by each fitting and to produce an extremely uniform light distribution over the whole court without undue wasted light. The "cut-off" of the fitting is such that only a fraction of the lamp filament is visible to the player serving. There is spill light at the centre of the court to a height of 24ft, and in practice it has been found that this gives adequate light for players to deal satisfactorily with most lobs. The electrical contractors were R. J. Stearne of Luton.

A game in progress on a B.T.H. floodlit tennis court at Paddington Bowling and Sports Club

British Week at Maastricht

The City of Maastricht in Holland held a British week from 13th to 20th June, when the central square of the city, the historic and picturesque Vrythof, was given over to British exhibitors participating in a miniature B.I.F. Pavilions displaying typical British trades and industries were erected on plots beneath the trees which surround the square. The accompanying photograph shows Sir Nevile Butler, British Ambassador, being received at the G.E.C. pavilion by Mr. B. P. Verel, the company's agent. In the background may be seen a cylinder for a 1,000 A, 600 V pumpless air-cooled mercury arc rectifier typical of many supplied by G.E.C. to the Netherlands.

Mr. B. P. Verel, agent for the General Electric Co., Ltd., receiving the British Ambassador at the exhibition held at Maastricht

Association of Electrical Machinery Trades

The Association of Electrical Machinery Trades held its ninth annual general meeting at the St. Ermin's Hotel, Westminster, on 21st June, preceded by a luncheon presided over by the retiring chairman, Mr. G. W. Smith.

At the meeting Mr. Smith, in submitting his report on the work of the previous year, referred particularly to the Electrical Engineers' Exhibition at Earls Court in which the Association had participated for the first time. During the year the Association had become a subscribing member of the British Standards Institution. The chairman concluded his report by expressing his personal thanks to his fellow members on the Council and to the secretary, Mr. J. T. Morgan.

Following the adoption of the chairman's report the members elected Mr. C. E. Collins (Collins Electrical, Ltd.) as chairman for the ensuing year. In taking the chair, Mr. Collins, on behalf of the members, congratulated Mr. Smith on the excellent way in which he had carried out his duties during the year. Mr. F. H. Washington (E. J. Wilcock, Ltd.) was elected vice-chairman and Mr. E. W. Clark (C.S.S. Electrical Co., Ltd.) treasurer.

Decca Radar Development

Decca Radar, Ltd., has formed a new Radar Systems Division, with Air Commodore Michael Watson, C.B., C.B.E., as its head and Mr. S. J. Kyte as his assistant. In addition to marine radar, the company now embraces a wide field of radar activities including military systems, civil air aids, radar links and meteorological radar; it is these latter activities that will come within the scope of the new Division.

Twenty-five Years of Plastics

On 12th July *British Plastics* is publishing a special 25th anniversary issue showing how plastics have developed, and how products have improved, and, in many cases, extended the usefulness of those in other industries. Copies of the issue, price 2s 6d, which will be almost twice the normal size, can be obtained from all newsagents or direct from Dorset House, Stamford Street, London, S.E.1.

New Babcock & Wilcox Film

"Craftsmen Welders" is the title of a new film which Babcock & Wilcox, Ltd., have had prepared to show the extreme care that is necessary in the welding of present-day steam plant, and the exceptional measures taken in the training of Babcock welders, to ensure the maintenance of the same

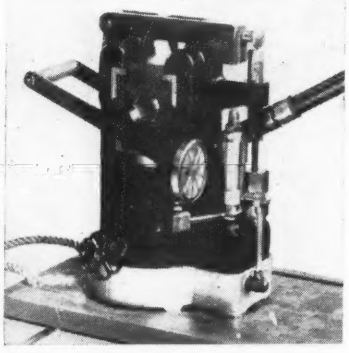
high-quality work on site as is achieved during manufacture of the component parts. Since a large modern boiler contains thousands of welded joints made at site the site welder has become a key man, and the instillation of the special skill for this particular type of work has become a very real problem. The steps taken by Babcock & Wilcox to ensure that a balanced force of craftsmen is always available are shown by a survey of their training school for site welders. The trainees are seen undergoing their course, tracing the various stages up to the final testing and inspection of the welds.

Point-to-Point Radio Services

Thirteen telecommunications specialists from ten countries are now attending a two weeks' course, organized by the British Council and the Post Office Engineering Department, designed to show how point-to-point radio circuits for the internal and overseas communications of the United Kingdom are planned, equipped and operated.

Overhead Line Jointing

Last week at the laboratories of Mr. R. H. H. Stanger at Elstree we witnessed a number of tests on aluminium and steel-cored aluminium overhead line conductors equipped with compression joints and tension clamps made by the Salvi Company of Milan, which is represented in this country by the English Salvi Co., Ltd., c/o Ferrum (England), Ltd., 43, Norfolk Street, London, W.C.2. The tests also included the making of a number of joints using the Salvi compressor.



Salvi compressor for overhead line jointing

The commonly used method of jointing overhead lines in this country is to place an oval sleeve with a circular hole through it over the ends to be jointed and then compressing the oval into a circular shape. This has worked satisfactorily but in the process of compression the line is deformed into an oval shape. In the Salvi method the sleeve is cylindrical and it is compressed into a hexagonal shape over the ends of line to be jointed. The company makes a comparatively lightweight hand operated compressor for this purpose and it is available with interchangeable dies to suit a wide range of joint sizes. As the compression is equal at all points around it the conductor is not deformed from its original shape and it is claimed that this provides a joint which is far superior to that obtained by any other method.

Greek Power Station Extension

Negotiations have been completed by the English Electric Co., Ltd., with the Whitehall Securities Corporation, Ltd., agents in London for the Athens Piræus Electricity Co., Ltd., for the supply and construction of extensions to the St. George's Bay power station near Athens, which was equipped and erected by the English Electric Co. in 1927. As already announced, the contract value is approximately £6·628 million.

The equipment includes a 60 MW hydrogen-cooled turbo-alternator and a 12·5 MW topping turbo-alternator, exhausting into the existing turbines; three boilers operating at 930 lb/sq in and 915 deg F; switchgear for the control of the alternators and auxiliaries; building extensions and foundations; and a considerable quantity of substation equipment including switchgear. The boiler installation will be capable of burning pulverized lignite or oil.

Works Visit

Members of the Ashton-under-Lyne section of the Electrical Contractors' Association, Oldham branch, with their chairman, Mr. H. Haughton, of Messrs. J. W. Marland, recently had an outing to the Lake District. They visited the factory of Ashley Accessories, Ltd., at Ulverston and, after being received by Mr. J. H. Petty, general manager, and other directors, the party inspected the manufacture of electrical accessories.

Radar for the South African Navy

A contract has been placed with Decca Radar, Ltd., by the South African Navy for the supply of Decca marine radar. This makes a total of twenty-six navies, including the Royal Navy, now using Decca radar in their fighting ships.

International Peat Symposium

A number of papers dealing with the use of peat in power generation are to be included in an International Peat Symposium to be held in Dublin from 12th to 17th July under the auspices of Bord na Mona.

Bakelite Exhibition

An exhibition of Bakelite, "Warerite" and "Vybak" plastics will be held at the Bowchier Hall Institution for the Blind, Newport Road, Cardiff, from 6th to 10th July.

Jersey Television Service

On 24th June a Rediffusion television service was opened providing wired television programmes to Jersey both from the British Broadcasting Corporation and from Paris. The B.B.C. hopes to start direct television service to the Channel Islands in about a year when a station is completed in Guernsey.

Cathode Ray Tube Factory

A start has been made preparing the 13 acre site at Pallion, Sunderland, for a new factory for the Edison Swan Electric Co., Ltd. The site work contractors are G. Wimpey & Co. Ltd., Newcastle-on-Tyne, and the general building contract will be let shortly. The new factory, which will employ several hundred workers, will be completed in about 15 months and will manufacture cathode ray tubes.

Change of Address

The Manchester office of the Electrical Power Engineers' Association is now at 95 and 96, Cromford House, Cromford Court, Manchester, 4.

Hair Dryers

In our survey of hair dryers on page 1188 last week, we stated that the Fractional H.P. Motors "Sylentflo" hair dryer was fitted with radio and TV interference suppressors. As this hair dryer employs a shaded-pole induction motor no suppressors are required or used.

Trade Announcements

Mr. J. D. Kendall has been appointed by the Thermovent Heating Division of **E. K. Cole, Ltd.,** technical sales representative for Yorkshire, the northern area of Nottinghamshire and Northern Lincolnshire, including Lincoln. His address is c/o 73, Carr Manor Avenue, Leeds, 7. Before joining E. K. Cole, Ltd., Mr. Kendall was at the Leeds branch of Falk, Stadelmann & Co., Ltd.

The **British Thomson-Houston Co.'s** Lamp and Lighting Depot at Edinburgh is now at 12, Thistle Street. The telephone number is unchanged.

Perihel, Ltd., has moved to West Mall Works, 27–29, Rabbit Row, London, W.8.

Sales inquiries for **Burco, Ltd.,** can now be handled in the London area by Mr. G. S. Hones at his new address, 64, Formby Avenue, Stanmore, Middlesex (telephone: Wordsworth 6213).

The **Quasi-Arc Co., Ltd.,** has now opened a new store at the premises of its associated company, Fusarc, Ltd., at Team Valley, Gateshead (telephone: Low Fell 7-5466).

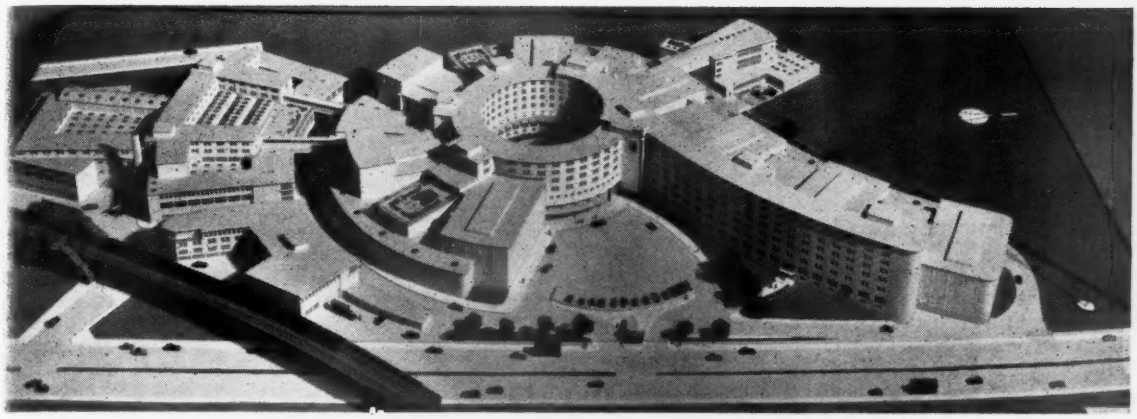
G.B.M. (Electrical) Birmingham, Ltd., has appointed Mr. A. Sloss, 15, Wellington Street, Glasgow, C.2, as its agent for Scotland. He will carry stocks of the company's oil filled electric radiators and immersion heaters.

Catalogues and Lists

Pressed Steel Co., Ltd., Cowley, Oxford.—Illustrated broadsheet dealing with the range of "Prestcold" refrigerated display cabinets (Z201).

Geo. W. King, Ltd., Stevenage, Herts. —Leaflets giving details of the "Marvex" electric chain pulley block.

S. Brod & Co., Ltd., 31/33, Priory Park Road, N.W.6.—Technical folder dealing with the company's ST101 timer and HS4 contactor.



B.B.C. Television Centre

LAST week we had the opportunity of inspecting the completed scenery block of the B.B.C. Television Centre at the White City, London. This building, which covers about an acre, is the first part of the project to be completed. Extensive workshops are provided for carpenters, property-makers, scenic artists and others engaged in the making of scenery for studio productions. There is also a 26ft high setting-space where scenery is assembled, together with large areas in which scenery and properties, suitable for re-use, can be stored. The block building contains in addition 200 offices for the use of administrative staff, producers, designers, etc.

The main block will consist of a multi-storey "ring," providing accommodation for dressing rooms, wardrobe service, engineering, and offices, around a garden of 150ft diameter. Radiating from it will be television production studios and their ancillaries, together with two "presentation" studios (where announcements, captions, etc., are inserted), telecine and telerecording areas, and a central control room. The outer periphery of the studios will be enclosed by a continuous runway, along which units of scenery, properties, etc., can be conveyed from the scenery block direct to the studios, these services being thereby segregated from areas allocated to artists, etc.

Work has just begun on the canteen block. Initially, it will be divided and used for rehearsal purposes, but when the main block is occupied it will be equipped as a canteen to serve 750 diners at a sitting. It will later be connected with the main block by a tunnel, and by a bridge across the road outside the scenery runway.

The works block will house the workshops for the maintenance and repair of technical equipment and an experimental laboratory where lighting and optical effects can be tried out. It will also provide accommodation for staff engaged on building maintenance. The Centre will have its main entrances in Wood Lane and a secondary entrance in Frithville Gardens, which leads to the B.B.C. television studios in Lime Grove.

In the scenery block duplicate high voltage supplies from the London Electricity Board network feed the main h.v. switchgear which in turn supplies the l.v. distribution board via two 500 kVA step-down transformers. The l.v. supply is then carried to the sub-switch feed-boards for connection to the main wiring system.

Adjacent to the main substation area is a small 110 V emergency lighting battery for maintaining essential scenery block services, i.e., the boiler room and the main electrical power intake area. The substation areas have been fitted with carbon dioxide fire protection equipment whereas the remainder of the block is provided with sprinkler equipment.

Space is available in the scenery block for extension of the switchgear to feed the main site and also for the main emergency lighting battery. A l.v. ring main will be used to connect with the substations situated in the main block and in these will be equipment for conversion to l.v. a.c. for technical, power and lighting supplies and to 110 V d.c. for studio lighting.

The architect for the work is Mr. Graham Dawbarn, C.B.E., M.A., F.R.I.B.A. (Norman & Dawbarn) in association with Mr. M. T. Tudsbery, C.B.E., F.C.G.I., M.I.C.E., consulting civil engineer to the B.B.C. The general contractors for the scenery block are Higgs & Hill, Ltd.

Steam and Power Survey

THE table reproduced below from the Ministry of Fuel and Power's "Statistical Digest, 1953" (see *Electrical Review*, 25th June) shows the number, capacity and annual output of generators in plants installed in 2,005 establishments out of 3,858 which completed the questionnaire. The remaining 1,853 used no engines or turbines. Total annual steam production was 430,600 million lb in 11,158 boilers, which used 45·9 per cent of the 59,541 tons consumed for all purposes by the undertakings concerned. The aggregate quantities of steam in millions of lb used in an average working week in winter were 4,969 for engines and turbines, 1,246 for space heating, 3,154 for process; total 9,369. In summer weeks corresponding figures were 4,379, 89 and 2,894; total 7,363.

Number and capacity of, and annual production from, various types of engines and turbines. (This table relates only to establishments that completed questionnaires)

	Back pressure (a)	Pass-out (a)	Other steam (a)	Diesel	Other	Total
No. of establishments	835	239	798	499	66	2,005(b)
No. of engines and turbines	2,430	398	1,557	981	166	5,532
Capacity (c)—						
Driving generators (MW)	584	794	841	168	61	2,448
Other (1,000 b.h.p.)	248	36	724	22	36	1,066
Total (d)—						
1,000 b.h.p. ...	1,028	1,093	1,846	245	117	4,329
MW	770	821	1,384	184	88	3,247
Annual production—						
Electricity (million kWh)	1,511	2,498	2,913	113	252	7,287
Mech. energy (e) (million b.h.p.-hrs)	757	121	1,850	20	168	2,916
Total elec. equiv. (d) (million kWh)	2,079	2,589	4,300	128	378	9,474

(a) Boiler auxiliaries and steam hammers and presses are excluded.
(b) This is the total number of establishments using one or more types of engine or turbine.
(c) Maximum continuous rating.
(d) Assuming one b.h.p. = ¾ kW, and one b.h.p.-hr = ¾ kWh.
(e) Mainly estimated.

Factory Inspector's Report

FEWER ACCIDENTS IN 1952

THE annual report of the Chief Inspector of Factories (Sir George Barnett) for 1952 published only last week (Stationery Office, 6s 6d) shows the number of accidents in industry to have been 267,410, of which 692 were fatal —the lowest recorded in each case since the Factories Act of 1937 came into operation and 25 per cent less than in that year. The most striking reduction (by half) related to power driven and transmission machinery. Accidents at prime movers, however, almost doubled.

Reportable electrical accidents (i.e., those causing more than three days' disablement) totalled 921, including 38 fatal. In addition 98 fatalities were known to have occurred in places not covered by the Act; 56 of these were on domestic premises and 42 on miscellaneous industrial or similar premises. The 683 reportable non-fatal accidents included 158 cases of eyeflash from electric welding. Excluding eyeflash, skilled workers were involved in 287 accidents (11 fatal) and unskilled in 268 (27 fatal), switchgear below 650 V being responsible in 105 instances (2 fatal), compared with 37 above 650 V (8 fatal). Portable apparatus and cables and plugs and adaptors formed the most dangerous group, viz. 142 (14 fatal). Voltages under 250 were notified for half of the 38 deaths. Artificial respiration was applied successfully in 16 cases (8 within ten minutes) and unsuccessfully in 21 cases (in 10 it was relaxed within half an hour). It is emphasized that efforts should not be relaxed until it is certain that there is no further hope. In 12 of the successful cases and 16 of the unsuccessful the voltages were up to 250.

Shock risk from portable apparatus should be lessened by stepping down the voltage to 110 V by means of a double wound transformer with mid point earthed. This transformer is preferably fixed rather than portable, but if a portable transformer must be used, the case should be insulated and the connecting cable short. Switches fitted to appliances fed from two-pin reversible connectors should be of the double-pole type. The mechanical and electrical soundness of the earthing system should be tested by means of a substantial current and its resistance periodically checked to ensure operation of fuses or circuit breakers on earth faults.

Pre-coiled t.r.s. flexibles, moulded in the form of a spring, have advantages, except where a number of tools are used near to each other, in which case spring loaded reels, which keep the tool suspended when out of service, are desirable. Descriptions are given of numerous electrical accidents, including fires and explosions, with comments on how these could have been avoided.

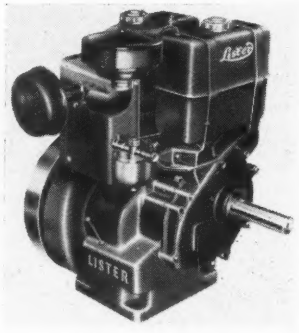
Power Station Risks

A criticism of boiler-control panels in new power stations relates to the narrowness of the space that has been allowed for maintenance near exposed conductors. This is being rectified by shrouding all conductors in appropriate groups by removable insulating shields. In the use of hydrogen cooling for alternators, experience in the U.S.A. suggests the possibility of three main risks of ignition, viz. from metering or recording instruments within the casing, such as opacity and density meters and pressure gauges; from faults on "unsafe" circuits; by escape of hydrogen from instruments or pipework on control panels; from escape of gas in and about the foundation block due to pipe breakages, faulty joints or wrong manipulation of valves. Intrinsically safe circuits for hydrogen have recently been certified and proprietary circuits are available for such purposes as alarm connections. Reference is made in the report to the growing need for special training of engineers for the maintenance of electronic equipment and to radiological developments in industry.

The number of accidents that occurred in electrical engineering works was 6,127 (13 fatal) and in electrical stations 2,531 (16 fatal). There were also 22 reportable dangerous occurrences in the first case and 91 in the second, 2 and 75 respectively being caused by short-circuit on failure of apparatus attended by explosion, fire or structural damage and involving a stoppage of not less than five hours.

Small Diesel Engine

TO meet the need for a prime mover which can be easily maintained, is simple to operate, and economical to run under all conditions of service throughout the world R. A. Lister & Co., Ltd., Dursley, Glos., have developed the 3½ h.p. "AD" air-cooled four-stroke diesel engine. The power output is 3½ h.p. at 1,800 r.p.m., 3 h.p. at 1,500 r.p.m., 2 h.p. at 1,000 r.p.m., and 1¼ h.p. at 900 r.p.m. Fuel oil consumption is 0·55 lb/b.h.p./hr while the lubricating oil consumption is 1½ per cent of the fuel oil consumption. The governor performance is in accordance with the appropriate British Standard or better at all speeds and at 1,500 and 1,800 r.p.m. the settled variation is ± 1½ per cent.



Lister type AD air-cooled diesel engine

In overall size the "AD" is similar to the Lister "D" type petrol or vaporizing oil engine so it can replace many such prime movers provided the speed requirement is suitable for the duty involved.

The crankshaft is taper-ended to take the fly-wheel which is keyed and held by a retaining screw. Pulley drives are available either from bolt-on type pulleys fitted to the engine fly-wheel or from key-on type pulleys mounted on a crankshaft extension which can be fitted to the fly-wheel. Pulley drives can also be taken from the half-speed shaft.

Apart from normal hand starting, electrical starting is an optional extra. As in all diesel engines, there is a compression release system for easy starting and this is actuated by a small lever working through the top cover to the cylinder head. Unified threads are used wherever practical in the manufacture of the "AD" engine. The price of the engine is £69 12s 6d.

OVERSEAS ELECTRICAL TRADE

Export Business Recovers in May

ALTHOUGH still well below the March total of £16,944,718, exports of electrical machinery and apparatus last month recovered from £14,074,867 in April to £15,310,254, which is £879,601 more than in May last year. The improvement has resulted in the cumulative figures for 1954 so far (£74,732,472) surpassing by £803,924 the total for the first five months of 1953.

In view of the intensified competition from other countries this minor advance, though giving no cause for complacency, can be regarded as not unsatisfactory. Considered from the point of view of the whole range of products, the results for the first five months of 1954 present a more favourable picture than might appear at first glance since the progress was made despite a decline from £13,628,319 to £8,759,330 in cable sales.

Increased buying by Russia (£922,667 compared with £8,689) and the United States (£300,963 compared with £155,391) contributed largely to a rise from £12,991,037 to £13,326,343 in shipments of generators and motors in January–May. Last month Russia (£184,352) was the fifth most important market, only South Africa (£296,320), Australia (£257,478), New Zealand (£225,586) and India (£210,704) buying more. Business in other electrical machinery remains on much the same level as in 1953, with Australia (£494,163) and India (£367,606) the largest purchasers in May.

A decline from £1,667,170 to £924,291 in business with South Africa was the main cause of a drop from £7,279,491 to £6,854,551 in telegraph and telephone equipment exports this year. Brazil was, however, one of the bright spots in this market, raising its purchases from £69,994 to £324,567. The decrease in cable sales was general throughout all markets, the most serious declines occurring in business with India (from £2,840,712 to £1,327,544), South Africa (from £1,520,856 to £730,325) and Australia (from £1,307,711 to £489,536).

A full analysis of exports of the various classes is given in Table I, with destinations shown in Table II. Apart from the items covered by these figures a considerable number of electrical products are to be found in other sections of the official returns. The January–May figures for these include washing machines, not exceeding 150 lb weight, £1,387,152 (compared with £1,055,667 in the corresponding period of 1953); ditto, over 150 lb but not exceeding 250 lb, £580,191

TABLE I.—ELECTRICAL EXPORTS

Class	May, 1954	Five months ended 31st May	
		1953	1954
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	96,830	416,971	495,528
Ditto, 10 to 65 kW	221,087	783,763	723,469
Ditto, 65 to 200 kW	166,813	514,057	419,854
Ditto, over 200 kW	390,577	499,585	1,725,809
Spark ignition engine driven	21,179	136,060	101,703
Steam turbine driven	46,258	991,418	367,092
Other prime mover driven	209,392	227,438	406,168
Generators	252,463	1,406,740	1,233,301
Parts of generators	430,500	2,575,262	2,143,157
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p	187,222	623,843	898,086
Over ½ h.p. but under 1 h.p.	59,198	181,836	240,750
1 h.p. to 250 h.p.	359,595	2,027,723	1,991,496
Over 250 h.p.	140,664	505,011	726,834
Railway, tramway and trolley-bus motors complete and parts of all motors	170,200	922,555	812,091
Motor starting and controlling gear	167,759	1,178,775	1,041,005
Converting machinery	36,640	194,265	156,208
Mercury-arc rectifiers	95,614	271,724	280,177
Transformers for lighting, heating and power (incl. coils)	1,038,359	5,155,481	5,303,270
Switchgear and switchboards (not telegraph or telephone)	1,256,188	6,730,546	6,660,725
Primary batteries:			
Lighting	83,743	253,795	354,510
Radio	163,810	420,636	743,478
Other	51,917	248,554	234,547
Parts (excl. carbons)	43,688	112,228	283,755
Lamps:			
Filament, exceeding 24 V	78,307	336,883	365,853
Ditto, under 24 V	24,274	109,879	142,633
Discharge lamps, fluorescent tubes, etc.	53,309	195,042	296,096
Other lamps	13,620	86,394	153,094
Radio and television, etc., apparatus:			
Cathode-ray tubes	8,680	44,304	49,640
Other valves (not X-ray)	166,639	887,220	821,746
Radio and television transmitters	99,671	376,022	346,762
Commercial radio and radar equipment	1,086,179	3,737,186	5,060,832
Domestic radio receivers, mains	217,954	1,049,984	828,941
Ditto, battery	63,379	228,260	273,439
Ditto, other (incl. car)	16,768	84,415	56,436
Radiograms	39,522	224,567	180,058
Television sets	16,658	174,727	81,854
Public address equipment	58,570	255,144	299,209
Sound reproducing app., n.e.s.	49,051	73,622	112,694
Components and parts, n.e.s., incl. parts of valves and c.r. tubes	659,510	2,131,685	2,864,596
Telegraph and telephone installations	603,961	2,236,788	3,097,981
Telephone instruments, separately consigned	129,888	972,596	602,244
Telegraph and telephone parts	503,074	3,241,314	2,320,483
Line apparatus for long distance commun.	125,220	828,793	833,843
Cookers	74,249	234,695	313,844
Toasters	23,779	83,429	90,646
Other cooking apparatus	30,384	90,425	137,009
Parts and accessories	42,472	130,883	192,138
Space heating appliances	30,333	104,937	181,448
Water heating appliances	27,735	142,496	140,322
Other heating appliances	29,736	130,565	180,069
Parts and accessories	69,724	232,072	242,222
Irons	70,688	215,413	324,553
Arc welding equipment, a.c.	31,165	283,997	199,199
Ditto, d.c.	54,776	228,323	239,692
Resistance welding equipment	9,858	48,234	54,857
Magnetos, ignition	17,989	120,392	78,776
Sparking plugs	149,483	583,617	742,326
Elec. appliances for aeroplanes, n.e.s.	161,348	645,500	1,045,289
Ditto, for motor vehicles, n.e.s.	230,378	855,730	1,175,813
Ditto, for cycles, n.e.s.	83,942	286,234	423,106
Signalling app. (incl. traffic signals)	41,015	318,095	287,142
Industrial radio-frequency equipment	22,443	62,450	113,827
Bell app. (not telegraphic or telephonic)	9,836	34,691	44,029
Instruments, commercial	160,314	673,302	755,058
House service meters (not prepayment)	114,329	432,244	575,856
Ditto, prepayment	19,244	46,052	96,175
Electro-medical apparatus (not X-ray)	41,781	178,772	222,919
X-ray apparatus (excl. tubes and valves)	55,183	323,111	234,188
Vacuum tubes	21,468	117,119	101,190
Desk fans	53,781	171,217	180,549
Ceiling fans	148,711	549,942	536,602
Vacuum cleaners	156,027	615,361	927,118
Floor polishers	128,717	313,247	580,400
Food mixers	52,835	194,285	243,223
Hair clippers and dry shavers	75,962	183,744	392,458
Other portable appliances	24,338	94,660	132,098
Parts	69,670	216,024	362,956
Portable elec. tools (not saws) and parts	166,156	726,548	768,083
Cables and wires:			
Telegraph and telephone, submarine	13,743	262,471	258,313
Ditto, other	318,654	3,475,873	1,897,301
Cotton, silk or art. silk insulated	35,054	353,734	204,454
Enamel, glass or asbestos insulated	58,325	446,079	331,424
Paper insulated	492,973	5,208,790	2,942,494
Rubber insulated	403,677	2,333,879	1,956,292
Other	259,810	1,547,493	1,169,052
Accumulators for motor vehicles	168,518	748,274	816,005
Ditto, traction	23,362	73,008	128,586
Ditto, radio and other portable	19,581	194,300	154,218
Ditto, other	53,423	288,377	304,662
Parts and accessories	57,159	274,967	314,953
Elec. porcelain, etc. (incl. insulators)	67,804	432,316	425,658
Insulating cloth and tape	57,125	209,139	232,555
Other insulating material	64,048	296,708	376,228
Permanent magnets	40,305	147,998	194,864
Radio, telegraph and telephone testing equipment, n.e.s.	27,981	141,015	182,793
Scientific elec. instruments (not telegraphic or telephonic)	206,660	757,386	980,511
Electrical machinery, n.e.s.	154,705	425,025	654,244
Electrical apparatus and appliances, n.e.s.	583,568	2,990,819	2,761,238
TOTAL	15,310,254	73,928,548	74,732,472

TABLE II.—DISTRIBUTION OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	May, 1954	Five months ended 31st May	
		1953	1954
	£	£	£
Channel Islands	70,573	207,757	274,976
Gibraltar	11,030	98,246	43,845
Malta and Gozo	12,251	147,230	250,592
Cyprus	43,536	226,674	335,848
Sierra Leone	17,789	104,780	70,562
Gold Coast	109,871	494,433	489,256
Nigeria	140,596	1,017,924	752,465
Union of South Africa	1,586,068	9,712,640	8,120,573
Northern Rhodesia	137,671	637,635	530,704
Southern Rhodesia	172,320	1,179,835	1,023,862
Tanganyika	68,580	272,491	269,058
Kenya	127,137	1,129,346	793,848
Uganda	58,616	377,424	388,842
Nyasaland	10,173	49,701	48,201
Mauritius	18,814	130,196	138,048
Aden	106,850	752,137	555,382
Bahrain, Qatar and Trucial Oman	195,122	520,789	695,302
Kuwait	159,954	806,192	796,215
India	1,307,647	8,363,550	6,595,418
Pakistan	503,759	779,142	2,631,214
Singapore	247,298	1,406,130	1,400,744
Federation of Malaya	201,312	1,452,675	1,132,894
Ceylon	151,160	761,726	644,594
British North Borneo	25,816	157,936	157,951
Hong Kong	125,189	1,064,689	837,922
Australia	1,646,987	7,926,010	7,391,241
New Zealand	761,169	4,142,654	3,964,607
Canada	812,236	3,484,162	2,840,734
Jamaica	44,345	286,246	314,574
Barbados	51,933	73,072	108,932
Trinidad	81,524	329,614	407,677
British Guiana	34,555	152,763	207,063
Anglo-Egyptian Sudan	170,106	557,040	552,366
Other Commonwealth countries	91,150	587,754	568,787
Irish Republic	277,356	1,642,984	1,358,113
Soviet Union	206,499	94,646	1,187,815
Finland	154,405	370,352	558,616
Sweden	447,429	1,610,399	1,810,489
Norway	195,198	1,276,046	1,206,065
Iceland	14,418	59,093	69,554
Denmark	196,064	422,368	980,677
Poland	54,484	591,978	427,986
Western Germany	112,776	394,474	526,207
Netherlands	527,307	2,037,969	2,760,472
Belgium	267,427	1,173,171	1,398,142
France	275,007	1,244,440	1,550,606
Switzerland	121,679	310,739	442,939
Portugal	119,374	515,573	1,171,231
Spain	143,431	1,358,354	1,126,142
Italy	225,793	953,581	1,193,650
Austria	118,500	199,280	421,272
Czechoslovakia	1,679	40,810	15,221
Yugoslavia	126,891	295,864	644,916
Greece	54,852	381,326	341,739
Roumania	—	171,255	1,662
Turkey	54,854	643,758	321,556
Netherlands Antilles	7,800	78,010	39,218
Belgian Congo	42,343	168,111	150,971
French Morocco	41,994	149,620	131,056
Angola	8,790	59,878	52,632
Portuguese East Africa	13,096	110,481	116,885
Syria	35,281	111,503	134,571
Lebanon	84,161	174,902	197,063
Israel	23,506	283,456	189,633
Jordan	17,418	106,442	113,233
Egypt	96,293	638,241	503,829
Libya	5,657	101,398	41,918
Saudi Arabia	51,995	215,744	266,862
Iraq	392,342	1,047,133	1,229,675
Iran	46,814	95,019	166,454
Burma	120,145	452,216	650,349
Thailand	256,720	715,544	600,331
Indonesia	44,948	379,107	228,430
Japan	20,303	193,773	213,136
United States of America	252,348	906,257	1,290,537
Cuba	27,551	89,204	120,328
Mexico	20,720	142,529	103,299
Colombia	67,531	275,176	302,447
Venezuela	164,001	696,852	727,511
Peru	82,242	174,163	183,032
Chile	39,137	152,460	161,151
Brazil	113,224	477,889	469,921
Uruguay	39,811	70,068	329,847
Argentine Republic	66,670	131,807	457,548
Other foreign countries	128,853	552,512	711,238
TOTAL	15,310,254	73,928,548	74,732,472

(£483,204); ditto, parts, £397,951 (£134,553); welding electrodes (excluding carbon), ferrous, £321,059 (£506,341); ditto, non-ferrous, £100,334 (£166,789); electric conduit tubes and cased tubes, £340,608 (£426,728); electric locomotives, £1,089,702 (£1,470,125); and diesel-electric locomotives, £1,147,100 (£284,407).

Of the £1,212,399 worth of electrical machinery and apparatus imported in May, Holland supplied £392,486, the United States £272,211, Canada £177,138, and Western Germany £107,084. The principal items were telecommunication equipment, £390,032; unspecified electrical machinery, £242,771; cathode-ray tubes, £147,265; and valves, £126,409. The five months' total was £6,037,584, which compares with £3,550,667 in January–May, 1953.

CABMA REGISTER

THE " CABMA REGISTER 1954–55 of British Products and Canadian Distributors " has been published jointly by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd., for the Canadian Association of British Manufacturers and Agencies, managers of the British Trade Centres in Toronto, Vancouver and Montreal. It comprises 780 pages, and is priced at 42s (by post 44s).

In his foreword to this, the second, edition, the chairman of the Dollar-Sterling Trade Council, Mr. James S. Duncan, C.M.G., says that " during the past year, sales of British products in Canada have shown a significant and encouraging increase. Some part of this growth is unquestionably attributable to the CABMA Register."

Certain improvements have been made in the new edition, both in the arrangement of the various sections and in the quality of paper used. The Buyers' Guide once again provides an alphabetical list of British products available to the Canadian market, with their suppliers given under each heading. There are more than 3,750 headings, and 1,300 cross-references. This section is now followed by a French-English Glossary, which gives the French equivalents of all the British product headings appearing in the Buyers' Guide.

An alphabetical directory of British Manufacturers and Distributors gives details of the 4,500 British firms which are classified by products in the Buyers' Guide, including their distribution arrangements in Canada, involving more than 2,750 Canadian companies; and some of these Canadian companies give further details in the Canadian Distributors' Announcements which follow. Advertisements, in which British and Canadian companies amplify the information given in their listings, have been included in these two sections, thus saving cross-reference to a separate advertisement section. Finally, the buyer is enabled to identify products and their sources of supply from their Proprietary Names and Trade Marks. The six sections of the Register are divided for easy reference by index cards, with reinforced tabs and containing instructions in English and French.

The completeness and efficiency of the Register have been made possible by the full co-operation of the following sponsoring organizations: the Dollar-Sterling Trade Council in Canada and, in the United Kingdom, the Dollar Exports Council, the Federation of British Industries, the National Union of Manufacturers and the Scottish Council (Development and Industry). Goodwill messages are included in the Register from the President of the Board of Trade, the Right Hon. Peter Thorneycroft, P.C., M.P.; the chairman of the Dollar-Sterling Trade Council, Mr. Duncan; the chairman of the Dollar Exports Council, Sir William Rootes, K.B.E.; and the president of the Canadian Association of British Manufacturers and Agencies, Mr. Lewis J-B. Forbes.

THE E.W.F.'s FORTY YEARS

Celebration Luncheon

IT was in 1914 that the Electrical Wholesalers' Federation had its origin in meetings of a few of the leading wholesale concerns; it was registered as a company limited by guarantee in the following year. To celebrate the Federation's fortieth anniversary a luncheon was held at the Dorchester Hotel, London, W.1, on Wednesday last week when the president (Mr. W. Crisp) and members of the Council and past-presidents entertained guests representative of the various other sections of the electrical industry and the technical and trade Press.

Mr. Crisp presided and referred with great regret to the recent death of the Federation's first president, Mr. R. W. Smith. After the loyal toast Lord Citrine, chairman of the British Electricity Authority, the principal guest, proposed the toast of the Federation. Lord Citrine said that he believed that people of like interests should get together and frame rules for the conduct of their affairs for their individual benefit. It was the policy of governments to obtain the views of bodies of people likely to be affected before proceeding with new legislation; it prevented them from doing foolish things. The trade union itself was the embodiment of the idea of combination and he had tried to impress on trade unions that it was to their benefit to conduct their negotiations with properly organized combinations of employers. He noted that two qualifications for membership were that the applicant must be genuinely engaged in the wholesale trade and must be prepared to further the interests of people engaged in the electrical trade. He thought that he could qualify on both counts—as a wholesaler of electricity to the Area Boards and certainly as regarded the second requirement.

Industry's Prospects

He commended the Federation's public-spirited approach; no section of the industry could be successful unless it had the interests of the whole industry at heart. The British Electrical Power Convention showed the excellent spirit of co-operation which existed in the industry. In meetings of the B.E.P.C. Council it would be impossible, without previous knowledge, to identify the individual interests of the members. He repeated what he had said at Eastbourne, that he preferred to rely upon fair treatment by those with whom he had dealings than any form of compulsion. No industry was more capable of withstanding economic shocks than electricity supply and if any shock came it would be relied upon by the Government to mitigate the effects. At the present time sales of cookers, water heaters and other appliances were rising rapidly and he had the utmost confidence in the industry's future provided the present co-operation and friendliness were maintained.

Mr. Crisp, in reply, expressed the Federation's appreciation of Lord Citrine's acceptance of their invitation. He said that forty years ago the founders of the E.W.F. had laid solid foundations upon which in subsequent years they had built a sound superstructure. The Federation represented the majority of the bona fide electrical wholesalers of the country and had always endeavoured to work in close harmony with other sections of the industry. They sometimes felt a little hurt when at some electrical meetings, conferences and conventions there was no mention of the wholesalers, although they were represented. Mr. Crisp concluded by expressing his confidence in the Federation's future.

Mr. A. B. Wildsmith, director of the E.W.F., announced that many congratulatory letters and telegrams had been received. He particularly mentioned a message from the National Association of Electrical Distributors of the U.S.A.

The toast of the past-presidents was proposed by Mr. T. D. Woods, who said that it was the past-presidents who had put the Federation where it was. He mentioned the death of Mr. Smith and also regretted the absence of Mr. G. O. Donovan and Mr. H. Riley (who was in America). He also paid tribute to his own father, Mr. T. Woods, and said that all the past-presidents had cultivated friendly relations with other branches of the industry.

At the E.W.F. 40th anniversary luncheon: Lord Citrine, Mr. W. Crisp (president) and Mr. W. Donovan

Mr. W. Donovan (president, 1919), responding to the toast, said that the Federation had carried out very necessary and vital work in rescuing the industry from the chaotic conditions which prevailed in 1914. The work was still necessary and must be continued on the same principles. Mr. Donovan made special reference to the late Mr. A. G. Beaver who had served the Federation in a variety of honorary capacities and was a man of outstanding character. If the E.W.F. stuck to its original principles and did not inflate its registers with names that should not be there it would continue to flourish.

The toast of the guests was proposed by Alderman J. W. Mayall (president, 1935) and the response was by Mr. R. D. McCraith, president of the E.C.A. of Scotland. Mr. Crisp thanked Mr. Wildsmith and the secretary, Mr. H. F. Wickham, for the success of the arrangements for the luncheon and Mr. Wildsmith made a brief acknowledgment.

To commemorate the anniversary the Federation has produced a brochure, " Forty Years of Federation, 1914–1954." This outlines the principal events in the Federation's history and makes particular reference to the past-presidents whose portraits are reproduced. It is noted that the Federation now has about 200 members who between them have 600 establishments throughout Great Britain and Northern Ireland.

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275 kV TRANSFORMER FOR STAYTHORPE

On 24th June the second of ten 120 MVA, 132/275 kV transformers with on-load tap-changing gear for the B.E.A. supergrid left the Rugby Works of the British Thomson-Houston Co., Ltd., *en route* for Staythorpe, where it is to be installed adjacent to the first transformer supplied just over a year ago. Although No. 2 transformer has been built to the same specification as the first, it is somewhat different in appearance and weighs about ten tons less, owing to improvements in design and manufacturing methods. Nevertheless, even when stripped for transport, the transformer weighs about 140 tons.

I.E.E. Summer Meeting

TOURING THE WEST COUNTRY

THIS week about 260 members and their ladies have been taking part in the Summer Meeting of the Institution of Electrical Engineers in the West Country.

Although the first official event of the meeting was not until Monday evening, when there was a civic reception at the Bristol Museum and Art Gallery, the guests being received by the Lord Mayor (Ald. G. G. Adams) and Lady Mayoress, a desirable atmosphere for the successful meeting was created during the afternoon by the arrival at frequent intervals of parties of the participants, all in jovial " summer meeting " mood, at their respective hotels.

On Tuesday there were four alternative all-day coach tours as follows: One of the Mendip country, with a visit to the Portishead " B " power station of the South Western Division of the British Electricity Authority; one through Gloucestershire with a visit to the Dudbridge depot of the Midlands Electricity Board, which includes the 33/6·6 kV distribution substation; a third through the Somerset countryside to Wells, with a visit to the works of Stothert & Pitt, Ltd., Bath; and one of the City of Bath, with a visit to the works of Sir Isaac Pitman & Sons, Ltd.

Portishead " B " Power Station

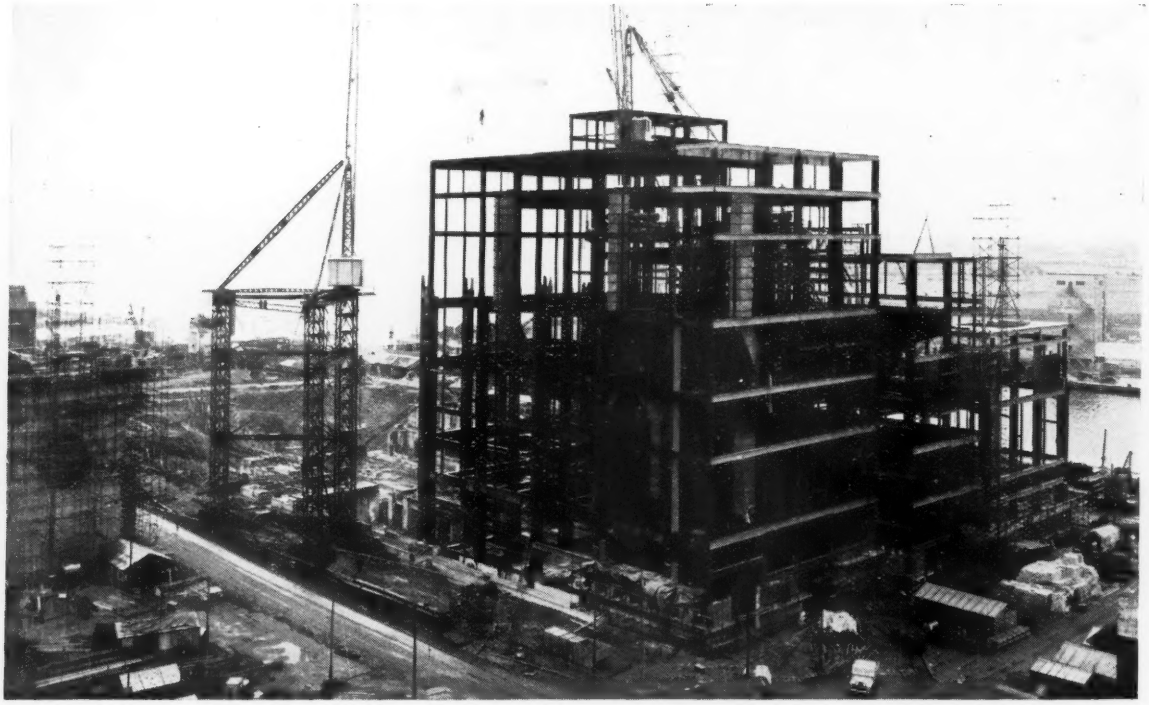
The Portishead " B " station is situated on the Severn Estuary between the existing Portishead " A " station and Portishead Dock. The station is planned to have an ultimate generating plant capacity of 360 MW, comprising six 60 MW turbo-alternators supplied by twelve 300,000 lb/hr boilers. The turbine steam conditions are 900 lb/sq in and 900 deg F. The first set is due for commissioning towards the end of 1955, Nos. 2 and 3 sets in 1956 and No. 4 set in 1957. Authorization has recently been received to install Nos. 5 and 6 sets and associated boilers in 1959 and 1960, but orders have not yet been placed for this last section of the station.

The plant is designed for burning South Wales coal which will be seaborne to Portishead Dock. Telpher type unloaders will unload the coal on to the belt conveyor system which will deliver the coal to the bunkers, to the working coal store, or into wagons for handling to the reserve store. The maximum rate of feed to the bunkers will be 400 tons/hr on a single 42in belt conveyor.

The boilers are being supplied by Mitchell Engineering, Ltd., and will have International Combustion, Ltd., p.f. equipment and corner fired furnaces. The boiler plant will include all-welded economizers, regenerative air heaters and both mechanical dust arrestors and electrostatic precipitators. The flue gases will be discharged through two 380ft high brick chimneys. All the boilers will be fitted with automatic oil ignition equipment which can also be used for pressure raising. A sluice system of ash handling will be installed.

The turbo-alternators will be the new Metropolitan-Vickers short-frame two-cylinder machines, the overall length being 72ft 2in. A special feature of the station will be the circulating water system. Four inverted horseshoe shaped culverts are being driven out to a dredged channel in the Severn Estuary. These culverts will connect to three 45ft diameter pump pits, each one being associated with two turbo-alternators. The concrete lined tunnels will each be about one-third mile long. On account of the extremely high tide range at Portishead the tunnel inverts will be

On Monday one party saw the new Portishead " B " power station in its present state of construction



at −37·5 O.D. level. Each tunnel will be intersected by a 21ft diameter 70ft deep pit which will contain two 72in wide vertical band screens with variable speed drives.

Each turbine will have a single horizontal condenser with a net cooling surface of 58,600 sq ft. The condensers will be split vertically to permit on-load cleaning. Due to the serious trouble from graphitic corrosion that has been experienced in the estuarine stations in the South Western Division, a special protective treatment is being given to the cast iron pipes, manifolds, and condenser and cooling water boxes. The condenser water boxes are to be electrically insulated from the tube plates and are being protected with synthetic coating.

The hydrogen cooled alternators will generate at 11·8 kV, the voltage being stepped up to 132 kV by a 72 MVA generator transformer situated just outside the turbine house wall.

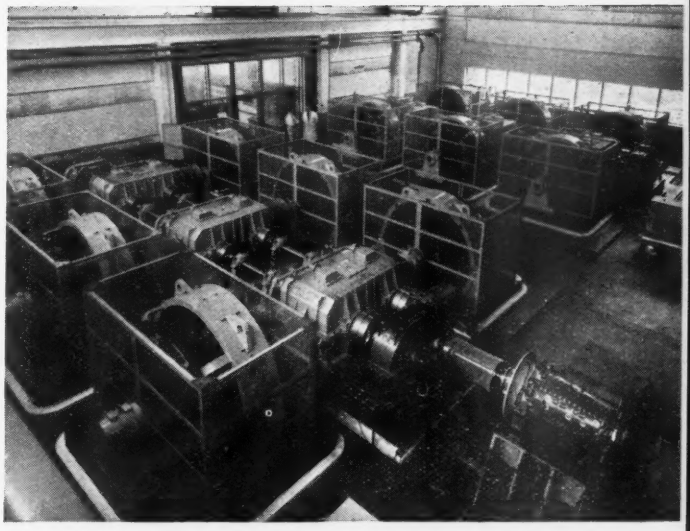
The Midlands Electricity Board site at Dudbridge comprises a substation, a transport depot, district office and a stores. The plant at the substation consists of two 12·5 MVA 33/6·6 kV transformers supplied as feeder transformers from Ryeford substation about 1·5 miles away. At the present moment supplies in this area are taken from Lydney generating station, but later this year a grid substation is to be established at Ryeford. The substation at Dudbridge supplies through indoor switchgear a 6·6 kV network covering Stroud and the neighbouring area.

Less than fifty years ago the electrical installation in the Stothert & Pitt works was supplied by a Belliss & Morcom-Siemens steam engine generator set at 110 V d.c. This was gradually replaced by a 460/230 V d.c. three-wire supply from the Bath electricity undertaking, but is now almost entirely superseded by an a.c. supply from the South Western Electricity Board. The factory is divided into two main works—Newark and Victoria. At Newark are situated the offices, tool room and erecting shops for cranes. The offices are fed at three-phase 415 V from a 6,600 V transformer. A portion of this factory also has a 460/230 V d.c. supply, which is also obtained from the Board. The supply to the Victoria works is mainly three-phase, a.c., at 6,600 V, from a transformer on site and partly at 415 V. D.c. is also obtained from a Mather & Platt 500 kW rotary convertor, again used principally for overhead travelling cranes and for testing purposes. Power factor correction condensers are also installed here.

At the works of Sir Isaac Pitman & Sons, Ltd., the electricity supply is partly d.c. at 440/220 V, partly a.c. three-phase 50 c/s at 400 V, and partly single-phase 50 c/s at 230 V. The maximum connected loads are d.c., 60 kW and a.c., 270 kW. An auxiliary supply is afforded by diesel generator for a.c. only. D.c. is largely used for variable speed motors of horse-powers between 2 and 12 for driving older printing machines, while a.c. is largely used for constant speed motors for driving smaller machines. Other electrical applications are heating in connection with glue tanks, the stereo press and the blocking press. The power factor varies considerably according to the balance of usage between power and fluorescent lighting, up to about 80 per cent. The total load is in the region of 130 kW, one-third of which is lighting. The power load fluctuates very considerably.

Also on Tuesday there were alternative visits to the following works: J. S. Fry & Sons, Ltd., Somerdale (chocolate); Bristol Aeroplane Co., Ltd., Filton; W. D. & H. O. Wills, Bristol (tobacco); and E. S. & A. Robinson, Ltd., Bristol (colour printing and carton making).

At the chocolate works an electricity supply is received at a power house and a substation at 6·6 kV. The maximum demand of the factory has increased steadily over the past ten years, and is now approaching 2,600 kW with an average load factor of just over 52 per cent. Three l.v. systems are in general use, 500 V two-wire d.c. and 400 V three-phase three-wire a.c. for power, and 230 V single-phase for lighting and small motors. On the 500 V d.c. system loads up to 900 kW are supplied through step-down transformers and six-phase motor starting, self-synchronizing rotary convertors, one a 250 kW B.T.H. machine, and two 500 kW Metropolitan-Vickers machines. The 230/400 V a.c. systems are supplied from seven oil immersed air cooled transformers varying in size from 300 kVA to 500 kVA with a total capacity of 3,150 kW.



On Tuesday and Thursday there were visits to the works of the Bristol Aeroplane Co., Ltd., where the electrical installation includes the 26,000 h.p. compressor-driving motors illustrated

The load at the Bristol Aeroplane Co.'s works is now over 30,000 kW. As there was no particular stage at which the introduction of a 33 kV supply could be justified, there are at present eight cables supplying the company's system at 11 kV. The older parts of the factory are fed through reactors which limit the fault value to 150 MVA, and the more recent substations are equipped with switchgear rated at 250 MVA. During 1947 three 1,200 kW diesel generators were commissioned. Subsequently six further 1,064 kW sets have been installed on two separate sites so that at present there is nearly 10,000 kW of private generation plant which is used for peak load reduction and is run at the request of the Electricity Board. There are fifteen substations, mostly containing, in addition to step down transformers, rectifiers or rotary convertors which supply an extra 500 V d.c. system. More recently the tendency has been to install individual transformers at load centres rather than to group transformers together in substations.

The steady production load is about 12,000 kW, about half of which is lighting. The main load is created by test plant and here the aggregate of the motor ratings is something over 60,000 h.p., including one turbine and compressor test rig with an output of 26,000 h.p., the d.c. motors being supplied and regulated by steel tank mercury arc rectifiers with grid control. Towards the end of the war, two Ward-Leonard regenerative dynamometer engine test beds were commissioned, one of 4,000 and one of 3,000 h.p. Utilization of electrical power includes heating in all its forms, every type of motor drive and a variety of lighting.

The Wills's Bristol factories as a whole consume about 5·25 million kWh a year with a maximum demand of 2,250 kW. Intensive development and mechanization which have been carried out during recent years have involved an appreciable increase in the use of electricity, to the extent of about 60 per cent more than immediately after the war. Private generating plant includes steam engines exhausting to the heating system, which are regularly used throughout the winter, and diesel plant which is installed for emergency service and for " peak lopping," all the Bristol factories now being on maximum demand tariffs. But the public supply provides about 85 per cent of the requirements and is taken at 11 kV. The bulk of the machinery is individually driven, Brook motors being used extensively. The number of motors installed in the Bedminster factory (excluding single-phase and office motors) is about 1,000, while at the Raleigh

Road group there are about 1,500. The majority of them are in the 1 h.p. to 5 h.p. range, the standard motor speed being 1,000 r.p.m.

The carton factory has a maximum demand of about 1,200 kVA on the South Western Electricity Board system at 11 kV. A h.v. feeder links the main substation to each of the four main factories which will also be linked eventually by means of a l.v. ring main. The maximum demand at the factory visited is about 450 kVA and the annual consumption is about 850,000 kWh. The supply is taken from a 400 kVA indoor transformer and from one of the l.v. interconnectors. The power factor at the point of supply is maintained at about 0·93 by means of static condensers mounted at fuse boards in various parts of the factory. The loading of the factory is roughly: production power, 50 per cent; process heating, 10 per cent; lighting, 25 per cent; boiler house auxiliaries, ventilation, etc., 15 per cent.

In two of the factories on the site the power load has been so arranged that in the event of a major emergency, such as a well-established fire, it is possible to trip out the power supplied independently from the lighting supply. The load at these factories is such that this tripping can be effected by means of latched-in contactors. The supply can be interrupted from various points in the factory, but can only be restored from the time-keeper's office.

On Tuesday evening the South Western Electricity Board and the South Western Division of the British Electricity Authority entertained the guests at a dinner-dance at the Grand Spa Hotel, Clifton—a most enjoyable function.

The whole party spent a full day in Cardiff on Wednesday, travelling both ways by steamer via the Avon Gorge and across the Bristol Channel. The Cardiff Civic Centre, gardens and buildings of interest were visited immediately on arrival, and after lunch there were alternative visits to the National Museum of Wales, Cardiff Castle, Welsh Folk Museum and the steelworks of the Guest Keen Iron & Steel Co., Ltd., which is an integrated works comprising coking and by-products plant, blast furnaces, open hearth steel melting and rolling mill departments. The production of coke amounts to 400,000 tons per annum, pig iron 550,000 tons and steel ingots 660,000 tons. Of the 14,000 ingot tons produced weekly about two-thirds is rolled into semi-finished bars and billets, the remainder being processed to finished sections. The works electrical intake from the South Wales Electricity Board is to three 33/11 kV 15,000 kVA transformers. The maximum demand on the Board is around 21,000 kW and the annual consumption is about 100 million kWh, with an average load factor of 58·5 per cent, but the company generates part of its electricity supply by a 3,500 kW Brush-Ljungstrom turbo-alternator, the steam for which is obtained from waste heat boilers and Thompson boilers fired with blast furnace gas. This set generates 30 million kWh per annum making a total of 130 million kWh consumed yearly.

One of to-day's excursions is to the Mendips, passing through Cheddar Gorge shown here

Yesterday there was an all-day visit to the Port of Bristol, which ranks seventh in the country; except on floating craft, such as grain elevators, tugs, etc., all the power used by the Port Authority itself and by its numerous tenants, is electric power. At Avonmouth, the largest of the three dock systems, the Port Authority purchases electric power and distributes it throughout the estate for its own purposes and for the use of tenants. The maximum demand for the whole port is now approximately 13,500 kW and 51 million kWh was consumed during the last 12 months.

Alternative half-day visits yesterday were to the Bristol University, the Bristol Zoo, places of historic interest in Bristol, and the following works: the Bristol Aeroplane Co., Ltd., the National Smelting Co., Ltd., Avonmouth, the Long Ashton Cider Research Station, and Strachan & Henshaw, Ltd.

In the smelting of zinc at the works of the National Smelting Co., large quantities of sulphur have to be removed in the form of sulphur dioxide, which is the basis of many chemicals manufactured on the site. Electricity is used principally for machine driving, and the South Wales Electricity Board supplies all the power required. The incoming supply is at 6·6 kV via various cables in parallel to a switching station from which ring mains are taken to eight substations. The maximum demand on this switching station is at present 5,500 kW with a load factor of 85 per cent, the consumption being at the rate of 40 million kWh per annum. Some 2,500 motors are in use, ranging from 0·5 h.p. to 325 h.p. on a variety of duties, including materials handling, pumps, fans, blowers and all night and every night lighting.

At the Cider Research Station of the University of Bristol the power requirements are met by a 100 kW transformer. The present load is from 40 to 60 kW, depending on the season. All the equipment is 230 V single-phase or 400 V three-phase. Electricity is used in the laboratories mainly for small bench equipment, with fractional h.p. motors. Larger motors of up to 5 h.p. are used in the cider house for driving apple mills, hydraulic presses, pumps and cold store equipment.

Electrical highlights among the production machinery at the works of Strachan & Henshaw, Ltd., are a perforating tubing machine 98ft long, which produces multi-wall tubes which, when sealed at the ends by a further operation, form paper sacks as used for packing such materials as cement, fertilizers, plaster and sugar. The driving equipment includes a 40 h.p. variable speed commutator motor, a centrifugally coupled 5 h.p. crawl motor, and some special control features. A 43in wide two-colour aniline printer for pre-printing the outer ply to be used subsequently on the tubing machine above operates at speeds up to 1,000 ft/min and is driven by a 30 h.p. variable speed commutator motor.

The social event last evening was a dinner-dance at the Victoria Rooms, Clifton, when the guests were received by the President of the Institution, Mr. Harold Bishop, C.B.E., B.Sc. (Eng.), and the chairman of the Western Centre, Mr. J. Vaughan Harries.

Although the summer meeting was concluded officially yesterday many of the participants are taking advantage of the " optional day " to-day when there are two alternative all-day excursions; one is to Longleat House, Heaven's Gate and Shearwater Lake, and the other is to the Mendips, including Cheddar Gorge, Glastonbury, Wells and Wookey Hole Caves.

Swiss High-Voltage Progress

Developments at the Oerlikon Works

DURING a recent visit to the Oerlikon Engineering Co., Zurich, we were afforded an opportunity of inspecting the new high-power testing station, which was officially opened on 25th June.

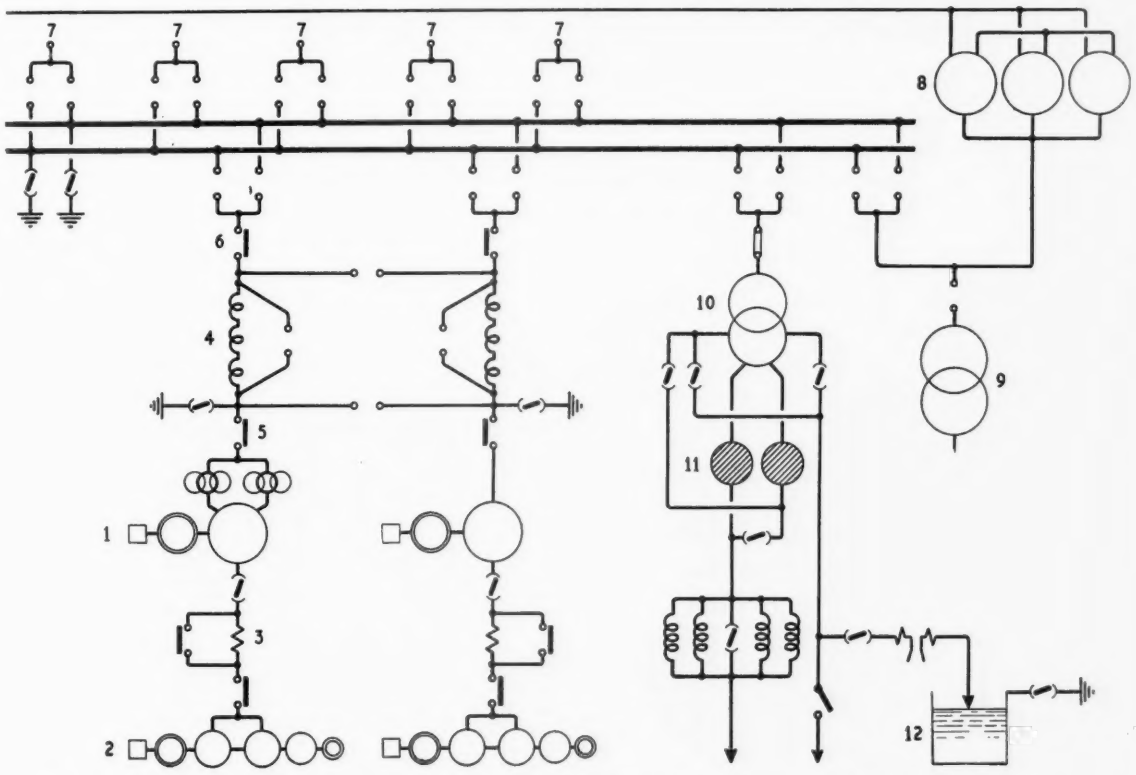
The first of two 14·5 kV 85,000 kVA 3,000 r.p.m. short-circuit alternators, driven by 1,000 kW induction motors supplied from the public mains, has now been installed with its impulse excitation set. This exciter has a continuous rating of 1,200 A at 1,600 V and is capable of giving 10,000 A instantaneously, thus raising the voltage on the generator rotor to about 20 times its normal value at the moment of application of the short circuit by bridging the associated resistance (Fig. 1). The short-circuit power is provided by the kinetic energy of the masses in motion.

The alternator windings can be connected in star or delta and in series or in parallel and the output is taken to the busbars through a back-up automatic breaker, reactors and a making switch, the making capacity of which is 1,500 MVA. From the busbar system five circuits are taken to the test cells situated 80ft from the control and observation building. A further circuit feeds outdoor 14/190 kV transformers having a short-circuit rating of 1,300 MVA and tappings to permit connection in series or in parallel, and supplying an overhead line strung in front of the test cells. By this means tests can be carried out at from 28 to 380 kV; at the highest voltages the mid-point of the two h.v. transformer windings are at earth potential. Alternating currents up to 200 kA at 720 V are obtainable from three-phase transformers and direct currents up to 80 kA at 600 V from mercury-vapour rectifiers.

Tests are directed from the observation room, with the aid of a drum type operation sequence controller, which switches off driving motors, initiates impulse excitation, applies the short circuit by the closure of the making switch, trips the test breaker, and opens and closes an oscillograph shutter. Completely processed oscillograms can be inspected within two minutes of exposure.

A new type of selector switch enables the instant of switching to be chosen so that no asymmetry occurs. Owing to the absence of a d.c. component the breaking operation can be initiated at the moment of application of the short circuit.

The switching in of the impulse excitation can also be so timed that the short-circuit current decays so little that the breaking capacity is not significantly lower than the making capacity. In this way the duties of the plant



(1) Short-circuit alternators. (2) Impulse excitation sets. (3) Impulse excitation resistances. (4) Reactors. (5) Back-up automatic circuit breakers. (6) Making switch. (7) Testing cubicles. (8) Main high-voltage power transformers. (9) Heavy-current transformers. (10) Transformers for rectifier installation. (11) Mercury-vapour rectifiers. (12) Charging resistances for rectifiers

Fig. 1.—Scheme of connections of new high-power testing plant

are appreciably lightened, since the electrodynamic forces increase with the square of the current.

The behaviour of circuit breakers when disconnecting long unloaded lines at any voltage can be ascertained by means of a 150 kV line which has been made available by the Zurich electricity supply undertaking.

Many examples of the use of " Orlite," notably in the construction of current transformers, were in evidence, especially where mechanical and dielectric strength coupled with high thermal conductivity and small water absorption were called for. This insulating material has a base of ethoxylin synthetic resins which melt at a low temperature, after which under the effect of a hardener they set by polymerization. As no volatile components are thereby developed the product can be cast without void formation and will then withstand temperatures of over 300 deg C without softening. Mechanical and thermal properties are claimed to be substantially improved in " Orlite " by admixture of inorganic fillers with the resin.

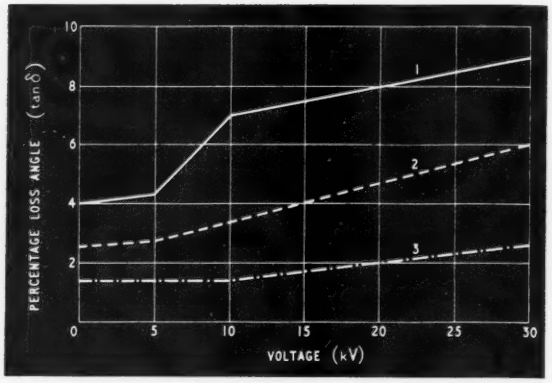
During the past two years ethoxylin-based resins have been applied in the form of " Orlite-Samicafolium " to prevent creepage of copper out of the slot insulation of stator windings due to thermal expansion of the metal at high temperatures up to 140 deg C. Its comparative dielectric properties were given as indicated in Fig. 2.

Most of the high-voltage circuit breakers seen were of the minimum-oil type, those for 220 kV consisting of two series-connected columns per pole, as adopted for 380 kV units supplied to Sweden. Up to 220 kV only one break per pole is employed. The moving contact is withdrawn in the downward direction, i.e., opposite to that of the escaping gases, which thus do not mix with oil outside the quenching chamber, to the upper part of which the arc is confined. Air-blast and bulk oil breakers are made only for voltages up to 60 kV, whereas minimum-oil designs cover the whole high-voltage range. Air-blast units were also on view for breaking duties of 60 kA, their normal rating being 5 kA at 20 kV.

Larger h.v. transformers (e.g., 42 and 22 MVA at 240 kV/$\sqrt{3}$) were mainly of the single-phase type to keep within maximum allowable transport weights and railway loading gauges. Their layer windings are built up from individual double-coil sections on cores of circular cross section with half-round yokes, and in many cases the h.v. connection is in the middle of the continuous coil. At voltages over 120 kV paper and presspahn are used for insulation as better able to withstand impulse testing than Bakelized paper. Examples of large alternators were two 33·5 MVA 375 r.p.m. machines for the new Maggia cascade group of water-power storage stations in southern Switzerland and two 28·6 MVA 68 r.p.m. " umbrella " units for the Birsfelden run-of-the-river station near Bâle. Excitation in the second case is provided by a separate 1,000 r.p.m. generator driven by a motor which is supplied from an auxiliary generator built on to the main generator, adding only 2·3 per cent to its weight. The auxiliary generator is excited from a permanent-magnet machine gear-driven from the turbine shaft.

All lightning arrestors, from 380 V up to 380 kV, consist of a nitrogen-filled spark gap, which is simultaneously a breakdown and quenching gap, and non-linear resistors with low discharge voltage/rated voltage ratio. Six-anode rectifiers are now confined to sizes up to 2,500 A and 1,800 V with air cooling, higher ratings being of the water-cooled single-anode type, excited by a permanent d.c. arc ignited on the splash-ignition system, as distinct from the ignitron, which is ignited afresh at the beginning of each cycle. The vacuum in all Oerlikon rectifiers is maintained by a simple two-stage pump.

Traction developments were exemplified by: rail cars



(1) Shellac micafolium. (2) Asphalt micafolium. (3) " Orlite-Samicafolium "

Fig. 2.—Dielectric loss angle for high-voltage stator insulation

for the Swiss Federal Railways, having a one-hour rating of 1,212 kW and a maximum speed of 60 m.p.h.; 100 kW shunting tractors; and tramcars and trolley-buses. Convertors were on view for the first two of twenty 50 c/s locomotives for the French railways; for these the trolley wire voltage is to be converted to three-phase at varying frequency. The gyro principle is being applied to buses and mining locomotives, mainly for export. In this a flywheel running in a hydrogen atmosphere is directly coupled to a three-phase induction machine. The latter is connected either to the supply line to accelerate the flywheel or to the driving motor, in which case it becomes a generator to transform the mechanical energy of the flywheel into electrical energy. Magnetizing current is supplied by a bank of capacitors of variable capacity, which also perform the same duty for the three-phase squirrel-cage driving motor, which above synchronous speed acts as a generator, breaking and recuperating energy from the vehicle to the flywheel.

The thermodynamic side of the company's activities is chiefly represented by steam and gas turbines; it is considered that the latter offer most possibilities for powers of 1,000 to 20,000 kW. An experimental gas turbine shown incorporates a multi-diffusor compressor designed specifically for such a use and a combustion chamber which permits good combustion of such diverse fuels as natural gas and heavy furnace oil.

Chinese Trade Visit

THE Sino-British Trade Committee announces that a party of Chinese trade experts which arrived in this country on 28th June will stay for about a fortnight. The party is led by Mr. Tsao Chung-shu and Mr. Shih Chih-ang, deputy directors of the China National Import & Export Corporation. The Sino-British Trade Committee, the headquarters of which are at the London Chamber of Commerce, is the joint body set up by the Association of British Chambers of Commerce, the China Association, the Federation of British Industries, the London Chamber of Commerce and the National Union of Manufacturers, which are the five organizations sponsoring the Chinese visit. The programme arranged by the Committee for the Chinese visitors envisages visits to factories in the London, Sheffield, Manchester and Birmingham areas, talks on matters of general principle affecting Sino-British trade, and meetings with representatives of industrial trade associations and of importers and exporters of Chinese goods. The aim of these talks and meetings will be to clear away existing hindrances to trade and to prepare the ground for a substantial increase in the exchange of goods and services.

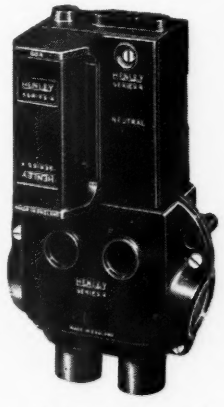
NEW ELECTRICAL EQUIPMENT

nsulated Service Fuses

A NEW range of insulated service uses, Series 4, for working currents up o 60 A, has recently been introduced y W. T. HENLEY'S TELEGRAPH WORKS o., LTD., 51–53, Hatton Garden, ondon, E.C.1. The range comprises single-pole model, a double-pole odel containing one fuse and a eutral connector, and separate sealing hambers for use with the double-pole odel. The design provides the maxi- num flexibility in the possible arrange- ents for the double-pole fuses with nd without sealing chambers. In the ingle-pole type single or double cable erminals are available up to 0·04 q in, for the incoming and outgoing onductors. All conductor entries are ell-mouthed and perfect clamping of onductors is ensured, particular atten- ion having been given to the satisfac- ory clamping of small conductors. All the conductor entries are protected nd provided with "knock-out" liaphragms.

The double-pole base consists of two compartments, one for the fuse- way, identical to the single-pole, the other for the neutral which can be supplied for one or two conductors, incoming and/or outgoing, according to those supplied for the fuseway. A separate cover is provided for the neutral connector. A moulded turret is supplied fitted to the fuse base to prevent accidental contact with live metal when the fuse carrier is removed.

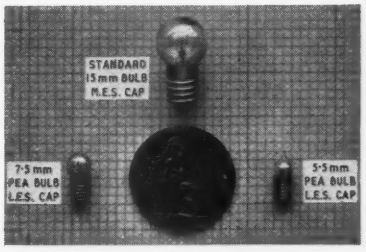
The cartridge fuse-links suitable for use with the Series 4 insulated service fuses are either the Henley Service 250, Service 440 and house service types and the rewirable fuse cartridges. Two sealing chambers are available for use with the double-pole model; one is provided with single vertical entry only, fitted with a moulded insulating gland, and the other with four entries, two vertical and two horizontal. The latter is supplied with either one or two moulded insulating glands, the unused entries being blanked by insulating diaphragms.



Henley double-pole Series 4 insulated service fuse and cable sealing chamber

Miniature Lamps

Following the introduction of l.e.s. pilot lampholders by A. F. Bulgin & Co., Ltd., l.e.s. capped pea bulbs covering a wide range of ratings from 1·5 V to 28 V are being made by VITALITY BULBS, LTD., Neville House, Neville Place, Wood Green, London, N.22. The illustration shows two of these bulbs compared with a standard



Two Vitality l.e.s. bulbs compared with a standard m.e.s. lamp and a penny

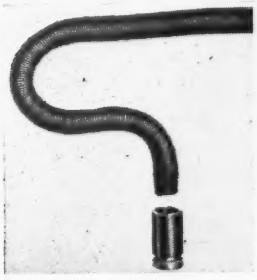
m.e.s. bulb. The overall lengths are (*a*) 17 mm ± 1 mm over pip for the 5·5 mm diameter bulb and (*b*) 16 mm ± 1 mm pipless for the 7·5 mm bulb. The standard ratings are 1·5 V, 2·5 V and 3·5 V at 0·3 A; 4 V at 0·25 A; 6 V at 0·2 A; 12 V at 0·15 A; 20 V at 0·1 A; and 24 V and 28 V at 0·04/0·06 A. The 5·5 mm bulb is at present available only in 2·5 V, 0·3 A, but the company emphasizes that it can "tailor" these to customers' individual requirements.

Flexible Conduit

Speed of installation, which shows a saving of up to 50 per cent man-hours is among the advantages claimed for "Clangduit" flexible conduit, which is being introduced by CLANG, LTD., Crown Yard, Cricklewood, London, N.W.2. The conduit is composed of two layers of paper interleaved with aluminium foil, bonded together with a synthetic thermoplastic compound, and finished externally with bitumastic material. The process of manufacture on the special winding machines forms a corrugation to make the finished tube flexible and durable. The internal paper layer is impregnated with oil to ensure smoothness of bore and facilitate the drawing of cables, while the corrugations, by locking the layers, provide flexibility.

"Clangduit" is only about one-tenth the weight of steel and can be easily carried, in coil form, in long lengths. It can be readily bent into any desired shape without the aid of tools, and no elbows or bends are required. Special bushes are available for connections with standard fuse boxes, junction boxes, tees, etc. Initially the conduit is being made in ⅝in and ¾in dia sizes, but eventually it is planned to extend the range to cover between ½in to 3in dia. Lead covering, armouring and other protective finishes will be available at a later date.

It is not claimed that "Clangduit" will supersede steel conduit, but it appears to have considerable advantages in certain situations. It should be noted that an earth wire is necessary, but even so there would be an overall saving on any installation as compared with one using steel. First deliveries of the conduit are expected to be made in August.



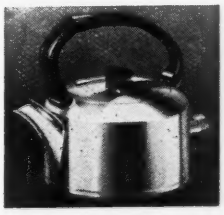
"Clangduit" flexible conduit

Fixing Clamp for Flush Switches

Another device recently introduced by Clang, Ltd., is a fixing clamp for flush switches. Consisting of two strips of steel at right angles, it automatically adjusts itself to fit any irregularities in the fixing recess, and the complete installation of the switch takes only about a couple of minutes. The clamp costs 10d.

Kettle

A feature of the 3½ pint "Family Contract" kettle brought out by BEST PRODUCTS, LTD., Felix Works, Felixstowe, is a safety engagement which prevents the lid from falling off when pouring and automatically positions the vents to deflect scalding steam away from the hand. The kettle, which costs £3 14s 6d, is constructed of heavy gauge copper, chromium plated outside and nickel plated inside.



Best "Family Contract" kettle

STOCKS and SHARES

BEFORE the end of June, the industrial markets of the Stock Exchange had more than recovered the fairly sharp reversal with which the month opened. By the beginning of this week, the share price indices were again in the neighbourhood of the highest-ever levels, although seeming to become increasingly sensitive to changes in the atmosphere of international politics. I.C.I. again broke all records in touching 70s 6d at one time, before reacting to 70s. A.E.I. also were particularly strong, and among others to advance well were Babcocks, B.I.C.C., Pye deferred, Parsons, Reyrolle, Walsall Conduits, E.M.I. and Cossor. Some more good company news items evoked ready responses from the shares concerned.

New Issue Activity

A growing number of companies is taking advantage of market conditions favourable for the launching of new issues. Among the latest of them is the Anglo-Portuguese Telephone Company with a public offer of a million 6 per cent preference shares at par, for which the subscription lists opened on Tuesday of this week. The same company's issue of ordinary shares was over-subscribed. Telegraph Construction's 5 per cent preference shares, offered earlier to shareholders at 20s, are being dealt in at a premium of about 6d. Both the E. K. Cole and Pye companies have announced within the past week or so their intention of raising fresh capital by "rights" issues of shares. Plessey have already taken that course, and the new 5s shares, issued at 30s, are quoted at 49s.

Company News

E. K. Cole 5s shares staged a further advance on the strength of the full report, which mentions the company's intention of making an offer of new shares to existing holders on favourable terms. The present quotation of 33s ex-dividend compares with 31s last week, and 28s 6d a fortnight ago. Reliance-Clifton Cables 5s shares moved up to 20s in advance of the final dividend declaration, but reverted later to 18s after the announcement, which leaves the total effectively at last year's rate of 35 per cent per annum. Profits are below the previous figures, but there still appears to be nearly four-fold cover for the dividend distributions. Electric Construction are again paying 15 per cent for the year, and the price of the shares at 61s 3d, is also unchanged.

Pye Finance

With the annual dividend and results for 1953–4 due to be announced shortly, Pye, Ltd., meanwhile gives preliminary notice of its intention to raise new money to the extent of £700,000 by a "rights" issue of 5s "A" deferred shares to existing shareholders. Terms of the offer are to be

Week's Price Change

Company or Board	Nom. Value	Middle price 28th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	93		3	3	3 4 6	93½	88⅜
Brit. Elec. 1974/77	100	92		3	3	3 5 3	92	87½
Brit. Elec. 1976/79	100	97½		3½	3½	3 11 10	97½	93 5/16
Brit. Elec. 1974/79	100	106		4¼	4¼	4 0 2	106	103 7/16
Overseas Electric Supply								
Calcutta Elec.	£1	21/6	+6d	6†	6†	5 11 7†	21/6	18/7
East African Power	£1	20/-		7	7	7 0 0	23/4	20/-
Nigerian Elec.	£1	24/6		10	10	8 3 4	25/-	23/6
Palestine Elec. "A"	£1	20/6		Nil	Nil	Nil	20/6	16/-
Perak Hydro-Elec.	£1	14/-		Nil	6	8 11 6	15/6	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	10/6		25	12½*	5 19 0	10/6	8/1
Aerialite	1/-	11/-		88½	88½	8 0 0	12/3	10/9
Allen, W. H.	£1	70/-	+3/9	15	20	5 14 4	70/-	50/-
Aron Elec. Ord.	£1	50/-		20	15	6 0 0	50/-	43/-
Assoc. Elec. Ord.	£1	55/-	+3/9	20	11½*	4 1 9	55/-	41/6
Automatic Tel. & El.	£1	73/9	+9d	15	15	4 1 3	75/-	62/9
Babcock & Wilcox	£1	59/6	+2/6	18	12*	4 0 9	59/6	47/3
Baldwin, H. J.	2/-	4/6		20	20	8 17 9	5/6	3/9
Bakelite	10/-	26/3		12½	12½	4 15 3	27/6	23/6
British Aluminium	£1	37/6	+3/-	12	10	5 6 8	40/-	34/6
B.I. Callender's	£1	43/-	+1/6	10	10	4 13 0	44/-	37/9
B.I. Callender's 6% Pref.	£1	26/-		6	6	4 12 3	26/-	24/3
British Thermostat	5/-	31/3	+1/3	35	27½*	4 8 0	31/3	17/6
British Vac. Cleaner	5/-	13/-		25	25	9 12 3	14/6	11/6
Brook Motors	10/-	42/6		20	20*	4 14 3	42/6	33/3
Brush Ord.	5/-	6/6		4	6	5 0 0	7/-	3/6
Bulgin, A. F.	1/-	3/3		30	30	9 4 6	3/7	3/2
Burco	5/-	14/6		35	35	6 0 8*	14/6	12/1
Chloride El. Storage	£1	62/6		20	12½*	4 0 2	62/6	46/6
Clarke Chapman	£1	55/6		17½	20	—	57/6	47/6
Cole, E. K.	5/-	33/-xd	+2/6	25	27½	4 3 4	33/-	22/6
Cossor, A. C.	5/-	8/-	+6d	10	10	6 5 0	8/11	7/-
Crabtree	10/-	29/3		17½	17½	5 19 8	29/6	23/9
Crompton Parkinson Ord.	5/-	17/6		11½	20	5 14 3	18/-	14/-
De La Rue	5/-	16/-	+2/6	Nil	20	6 5 0	16/6	12/3
Decca	4/-	38/-	+6d	150	35*	—	38/3	32/-
Desoutter	5/-	18/9		18	20	5 6 8	18/9	16/1
Dewhurst	2/-	6/-		19	19	6 6 9	6/3	5/1
Dictograph Tel.	2/-	6/-		20	20*	6 13 4	6/3	5/2
Dubilier Condenser	1/-	5/6	+3d	28	25*	4 11 0	6/-	4/1
E.M.I.	10/-	15/9	+1/9	12	8	5 1 6	15/9	11/3
Electrical Components	5/-	11/3		20	20	8 17 10	11/6	10/9
Elec. Construction	£1	61/3		15	15	4 18 0	61/3	53/-
Enfield Cable Ord.	£1	20/-		5	Nil	Nil	22/3	16/6
English Electric	£1	45/-	+1/3	15	10*	4 9 0	45/9	38/-
English Electric 3¾% Pref.	£1	16/6		3¾	3¾	4 11 0	16/6	15/3
Ericsson Tel.	5/-	25/9		22†	25†	2 8 6†*	26/3	22/9
Ever Ready	5/-	23/6	+3d	35	40	—	25/-	17/9
Falk Stadelmann	£1	37/6		15	15	8 0 0	41/-	36/6
G.E.C. Ord.	£1	42/6		22½	11¼*	5 6 0	44/6	37/6
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/3	26/6
General Cables	5/-	16/3		30	30	9 4 8	16/10	16/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	46/3	40/3
Hackbridge Cable	5/-	14/-		20	20	6 15 7	15/3	11/3
Hackbridge & Hewittic	5/-	22/6	+1/3	20	25	5 11 0	22/6	16/10
Hall Tel. Acc.	10/-	10/6		10	10	9 2 8	11/11	10/6
Heatrae	2/-	4/9		12½	12½	5 5 3	4/9	4/-
Henley's	10/-	19/6		10½	10½	5 7 8	19/6	15/6
Holophane	5/-	15/3	+6d	20	20	6 11 2	15/3	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

announced nearer the time of the issue. Apart from contributing towards the cost of new buildings and the provision of more working capital, the operation will go towards the repayment of an outstanding note issue which at present restricts the borrowing powers. The company's statement suggests that the latter are likely to be considerably exercised if turnover continues to increase at the present rate. On its general implications of large expansion still to come, and in anticipation of the new issue, the price of the 5s shares rose 4s 9d to 26s 3d.

in Electrical Investments

Company or Board	Nom. Value	Middle price 28th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	37/3	+1/-	25	45	6 0 9	37/3	26/3
I.C.I.	£1	70/-	+1/6	13	15	4 5 9	70/6	52/9
I.C. Combustion	5/-	23/-		15	20	4 7 0	23/-	14/6
Johnson & Phillips	£1	48/-	+6d	15	15	6 5 0	52/3	47/6
Lancashire Dynamo	£1	56/9		12½	14	4 18 9	56/9	43/-
Laurence, Scott	5/-	21/9	+1/6	15	20	4 12 0	22/-	14/-
Lister, R. A.	£1	43/-	+1/-	9	12	5 11 6	43/6	31/9
London Elec. Wire	£1	45/-	+1/3	15	10*	4 9 0	46/3	38/-
Lucas, J.	£1	66/3	+6d	9½	10½	3 5 6	66/3	50/3
Parryat & Scott	2/-	7/-		22½	25	7 2 9	7/-	5/11
Pitcher & Platt	£1	72/6	+6d	12½	15	4 2 8	72/-	53/1
Metal Industries	£1	32/3		15	12*	7 9 3	42/3	29/6
Midland Elec. Mfg.	£1	67/6		15	15	4 9 0	67/6	63/-
Morphy-Richards	4/-	18/9		40	40	—	18/9	11/4
Murex	£1	55/9	+1/-	15	15	5 7 6	56/3	50/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/6	2/-
Oldham & Son	1/-	3/-		35	17½*	5 16 8	3/4	2/5
Parnall (Yate)	5/-	6/9		6	8	5 18 6	6/9	4/3
Parsons, C. A.	£1	56/3	+5/-	12½	7½*	2 13 4	56/3	38/1
Plessey	10/-	48/9		25	30	—	54/-	37/10
Ord Deferred	5/-	26/3	+4/9	18	20	—	26/3	15/7
Revo	10/-	20/3	+9d	27½	27½	—	20/3	16/7
Reyrolle	£1	86/3	+3/9	12½	13¾	3 3 9	86/3	66/-
Rheostatic	4/-	12/6		19	20	6 8 0	12/9	11/-
Richardsons Westgarth	5/-	11/9	+1/-	12	15	—	11/9	6/6
Scottish Cables	4/-	17/-	−3d	20	27½	6 9 6	17/3	12/11
Siemens Ord.	£1	36/6	+6d	10	10	5 9 7	43/9	33/9
Smith (England), S.	4/-	10/9	+3d	12½	15	—	11/3	7/8
Southern Areas	£1	18/6		6	7½	8 2 2	20/-	17/6
Strand Elec.	5/-	8/9		17½	17½	10 0 0	9/3	8/3
Sturtevant	5/-	38/6	+1/-	18·1††	18·9*†	2 9 0†	38/9	29/-
Sun Elec.	£1	32/6		15	15	9 4 8	32/6	27/6
Switchgear & Cowans	5/-	12/9		22½	10	3 18 6	13/7	9/9
Taylor Tunnicliff	5/-	11/-		25	12½*	5 13 9	12/4	10/7
T.C.C.	10/-	32/6		20	30*	—	32/6	21/3
T.C. & M.	£1	30/3		10	8½*	5 12 6	34/6	30/3
Telephone Mfg.	5/-	8/6		10	10	5 17 9	8/6	7/6
Thorn Elec.	5/-	19/6	+9d	12½	12½	3 4 0	19/6	13/3
Thornycroft	£1	42/6		15	15	7 1 3	42/6	33/4
Tube Investments...	£1	66/3	−2/6	15*	15	4 10 6	68/9	60/3
Vactric	5/-	14/6xd		Nil	10	3 9 0	17/6	7/6
Veritys	5/-	6/9	+9d	10	12½	9 5 3	8/3	5/-
Walsall Conduits	4/-	52/6	+1/3	70	70*	5 6 8	52/6	44/-
Ward & Goldstone	5/-	55/-	+2/-	45	45*	4 1 10	55/-	41/3
Watford	2/-	6/-		25	22½*	—	6/3	4/7
Westinghouse Brake	£1	67/6	+1/3	14	15	4 9 0	68/10	60/9
West, Allen	5/-	14/9	+6d	15	17½	5 18 9	15/3	12/7
Wolf Electric	5/-	13/9	+6d	15	17½	6 7 3	13/10	11/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	82½		—	6	7 5 6	89½	80
Ord.	100	52½		—	3⅜	7 2 10	55½	52
Anglo-Portuguese	£1	21/9xd		8	8	7 7 3	24/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	55/-xd	+3/3	35	50	4 10 1	56/6	39/1
Cable & Wireless:								
Ord.	£1	38/-		8	9	4 14 9	42/6	26/2
4% Loan	100	98½		4	4	4 1 3	98½	95½
Calcutta Trams	£1	19/-	+6d	6†	2½††	—	19/3	17/1
Cape Elec. Trams	£1	15/-		5½	5½	7 6 8	15/3	12/4
Marconi Marine	£1	33/9		10	10	5 18 6	33/9	27/6
Oriental Tel. Ord.	£1	77/6	+6d	16	16	—	80/6	73/9
Telephone Props.	£1	4¾		8	8	—	5 1/16	4¼
Telephone Rentals	5/-	9/3		10	10*	—	10/3	9/-

Hackbridge & Hewittic Results

The declaration by the Hackbridge & Hewittic Electric Co. of a final dividend, making a total of 25 per cent for the year, means that shareholders will be receiving their fifth dividend increase within six years. After a pause in 1952–53, earnings of the group are shown in the latest preliminary profits statement to have resumed the upward course which has been otherwise uninterrupted since the company was made public in 1947. With the trading profit nearly 10 per cent higher at just above the half-million mark, there remains a comfortable margin over the amount of the ordinary dividend, the rate of which is 5 per cent above last year's, and double that paid five years ago. Already a firm market in anticipation of good results, the price of the 5s shares was subsequently marked up further to 22s 6d, easily the best figure ever recorded for them.

De La Rue Recovery

Thomas De La Rue's report of a trading profit of over half a million, for the year ended last March, exceeded the best expectations, as did the declaration of a 20 per cent dividend. Shareholders had already been advised in an interim report that they could expect better results than those for 1952–3, when a net loss was recorded and the ordinary dividend omitted. In the market, nonetheless, few had hoped to see the restoration of the dividend to a level so near the rate of 25 per cent (or its equivalent) paid for some years previously. Impressions were improved further by notification that the £900,000 bank loan was repaid during the year. The price of the 5s shares, which sank to about 6s 3d at the time of last year's results, advanced on this occasion to 16s. The yield works out at about 6¼ per cent on a dividend covered nearly twice by the year's distributable earnings.

National Electric Preference

Dealings began officially this week in National Electric Construction 5 per cent preference shares at about 19s 6d. Particulars advertised in connection with the marketing of the shares show that since the 1947 Electricity Act the company has been engaged mainly as a holding and investment business, with its interests centred on road transport. On the basis of last year's results, the preference dividend is covered over four times by profits, and the principal amount more than twice by the net tangible assets of the group. These shares result from a capitalization of reserves, and were issued in the first place to holders of the company's ordinary shares, all of which are in the hands of the British Electric Traction Co. The latter agreed to make at least 100,000 of the preference shares available to the market.

REPORTS and DIVIDENDS

Ferranti, Ltd.—The consolidated profit for the nine months ended 31st March, including dividends on investments, amounted to £1,446,649, as compared with £1,284,033 for the year to 30th June, 1953. After provision for tax (including £165,000 for E.P.L.) on all profits earned to date, the net profit was £546,863, against £436,248 last year. The capital issue expenses amounting to £6,982 have been written off. After providing for preference dividends, £330,765 has been transferred to general reserve account and an ordinary dividend of 6 per cent is recommended, leaving £31,063 to be added to the undistributed profits carried forward, which will then amount to £345,813. In a statement circulated with the accounts, Sir Vincent de Ferranti, chairman and managing director, states that the output of the group, which now employs 11,000 people, has risen by 14 per cent and has exceeded the input by £2,000,000, leaving unexecuted orders to the value of £15,000,000. Eighty-two major transformer units have been delivered during the past nine months, of which fifty-two were for export. The latter include five 300 kV transformers for the Aluminum Company of Canada and thirteen in the 230 kV class for New Zealand. Other notable equipment supplied has included a 3·2 million volt, 77 kW/sec, impulse generator for the N.P.L. The overseas markets for electricity meters have recovered. A number of new special machines for producing the FM meter are now in operation. The demand for radio and television receivers continues to rise and new and larger types of cathode ray tubes for television and other purposes have been introduced. The demand for domestic electrical appliances has also increased and the rate of output of fires has been trebled. Research and development work has kept well ahead in the field of electronic digital computors. The new research laboratories at Wythenshawe are now in full operation. Increasing competition experienced by the Canadian company in the transformer market is being met by improvement in design and extension of the range manufactured. Plans are also under way for producing a thermal demand meter.

E. K. Cole, Ltd., records a group trading profit for the year ended 31st March totalling £719,010 (£652,781). After providing for depreciation £77,845 (£69,922), taxation £407,500 (£400,600), etc., the net profit was £181,332 (£134,202). An ordinary dividend of 27½ per cent is to be paid and the carry-forward is increased from £257,326 to £366,470. The authorized capital is to be increased by the creation of £2,200,000 ordinary shares of 5s and as soon as Capital Issues Committee consent is obtained and the necessary arrangements made a substantial proportion of present unissued ordinary shares will be offered for cash on favourable terms to ordinary holders.

Richard Johnson & Nephew, Ltd.—Presiding at the annual meeting held on 25th June, Mr. M. A. T. Johnson (chairman) said that due to improved supplies of steel in the second half of the year they were able to catch up with the loss of business in the first half from the shortage of steel and they just achieved a record output. At present production was running at a high level and there was no shortage of orders. On the non-ferrous side of the business orders for copper wire and strip had been, and still were, hard to come by. Owing to uneasiness about the price of copper customers carried the barest minimum stocks. The chairman referred to the rising cost of the nationalized services, electricity, gas and rail transport, and said that large sums had been spent on modernization in order to cheapen production, but as fast as they made savings the effect was wiped out by the extra money they had to pay for services.

Pye, Ltd., has obtained Treasury consent to raise £700,000 by the issue of "A" deferred ordinary shares of 5s each. The shares are to be offered to holders of the deferred and "A" deferred stock registered as at 25th June on a "rights" basis at a price to be decided in the light of market conditions at the time. The proceeds will be devoted primarily to the redemption of the £500,000 of 4¼ per cent unsecured notes and to the cost of new buildings estimated at £100,000. Steps are also being taken to increase borrowing powers.

The Renold & Coventry Chain Co., Ltd., reports a group profit, before taxation, for the year to 27th March last of £660,879, as compared with £933,047 for the preceding year. Taxation absorbs £355,689, leaving a net balance of £305,190 (against £323,528). The dividend for the year is maintained at 11 per cent by a final payment of 8 per cent.

W. & T. Avery, Ltd., report that group profits, after all charges, including United Kingdom taxation of £1,245,772 (£1,005,953), amounted to £837,780 for the year ended 31st March, as compared with £688,539 in 1952–53. The profits attributable to the parent company were £825,646 (£671,741). The final ordinary dividend is increased from 10 to 15 per cent to make 20 per cent for the year (against 15 per cent). It is proposed to apply for consent to capitalize £1,025,014 of reserves and to make a free scrip issue of three £1 ordinary shares for every £5 ordinary stock held.

Reliance-Clifton Cables & Industrial Products, Ltd., is to pay a final ordinary dividend of 22½½ per cent, making 37½½ per cent for the thirteen months to 31st December, equivalent to 35 per cent per annum (same). The group trading profits for the period amounted to £308,612 (against £423,066 for the previous year) and net profits to £143,552 (£151,966) after taxation amounting to £129,850 (£234,906). These figures include profits for previous years £6,642 (£840) and E.P.L. repayable £6,000 (nil).

Hackbridge & Hewittic Electric Co., Ltd.—For the year ended 31st March the consolidated trading profit increased from £460,853 to £504,225 and the net profit from £154,158 to £167,767, of which subsidiaries retained £8,324 (£17,353). General reserve again receives £75,000 and the final ordinary dividend is increased from 15 to 20 per cent, making 25 per cent (20 per cent). The carry-forward is increased from £53,146 to £61,139.

The Morgan Crucible Co., Ltd., is increasing its ordinary dividend from 8¾ to 10¼ per cent, making 14 per cent (12½ per cent) for the year ended 31st March. The group profit is £1,565,635, against £1,524,482 in 1952–53. After taxation amounting to £888,455 (£816,836) there was a net profit of £677,180 (£707,646). A sum of £225,000 (£250,000) is allocated to general reserve and the carry-forward of the parent company is £111,307 (£118,855).

Thomas De La Rue, Ltd., report a group profit of £525,658 for the year ended 27th March, compared with a loss of £78,844 in 1952–53, when £134,93 was set aside for exceptional depreciation of stocks, in addition to £115,283 depreciation of current stock. After providing for taxation amounting to £360,896 (£51,835) and bringing in special credits of £95,000 the net balance is £259,762, compared with a loss of £125,679. It is proposed to resume ordinary dividends with a payment of 20 per cent. No dividend was paid in 1952–53, but a payment of 25 per cent was made in 1951–52.

Drake & Gorham, Ltd., propose to increase their ordinary dividend from 5 to 7½ per cent for the year ended 31st March. After providing for taxation, the consolidated net profit was £28,468 (£9,725).

The Electric Construction Co., Ltd., is maintaining the ordinary dividend at 15 per cent on increased capital for the year ended 31st March. After tax of £127,850 (£137,433), the net profit was £110,526 (£93,503). Reserves receive £65,000 (£55,000), and £66,065 (£62,530) is carried forward.

Marco Refrigerators, Ltd., have declared an interim dividend of 2½ per cent. The last dividend was an interim payment of 7½ per cent in 1950–51.

The Engineering & Lighting Equipment Co., Ltd., reports that at 31st March current assets amounted to £427,811 (against £340,956 a year previously) and liabilities to £140,385 (£163,898). For the first time for many years there was a bank balance of £76,937, against an overdraft of £31,211 in 1952-53.

Vent-Axia, Ltd., reports that for the year ended 31st March the group current assets totalled £307,968, current liabilities and provisions £89,696 and net assets £245,750.

Marryat & Scott Holdings, Ltd., are increasing their ordinary dividend from 22½ to 25 per cent. For the year ended 31st March the group net profits, after tax of £65,044 (£91,154), were £60,983 (£45,363).

New Companies

Light Weight Battery Co., Ltd.—Registered 23rd June. Capital £100. To take over all patents, plant, equipment, stock, recorded results, goodwill and improvements relating to experiments carried out by Francis L. R. Brown and Cecil H. Gadsden in the construction and improvements of electrical storage batteries, etc. Directors: C. H. Gadsden and F. L. R. Brown. Regd. office: Copthall House, 13, Copthall Avenue, London, E.C.2.

Greenside Electrical Co., Ltd.—Registered 2nd June. Capital £4,000. To acquire the business of electrical, radio and television contractors and dealers carried on by Robert Williamson at 114, Lower Wortley Road, Leeds. R. Williamson is governing director and chairman. Regd. office: 94, Lower Wortley Road, Leeds.

Brimetrix, Ltd. — Registered 17th June. Capital £2,000. Agents, wholesale

(*Continued overleaf*)

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Aluminium "Pylon"

Soundly constructed, made of heavy gauge aluminium and highly polished. Attractively priced at 55s. 6d., 1,500 watts, Cat. No. 2833, and 52s. 6d., loading 1,000 watts, Cat. No. 2833/A. Both models 3 pints.

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Made of heavy gauge copper, exquisitely finished in lustrous chromium plate. Cat. No. 2939, loading 1,500 watts, £3 17s. 6d. Cat. No. 2939/A, loading 1,000 watts, £3 14s. 6d. Both models 3 pints. Cat. No. 2947, 1,500 watts, £4 6s. 0d., 4½ pint capacity.

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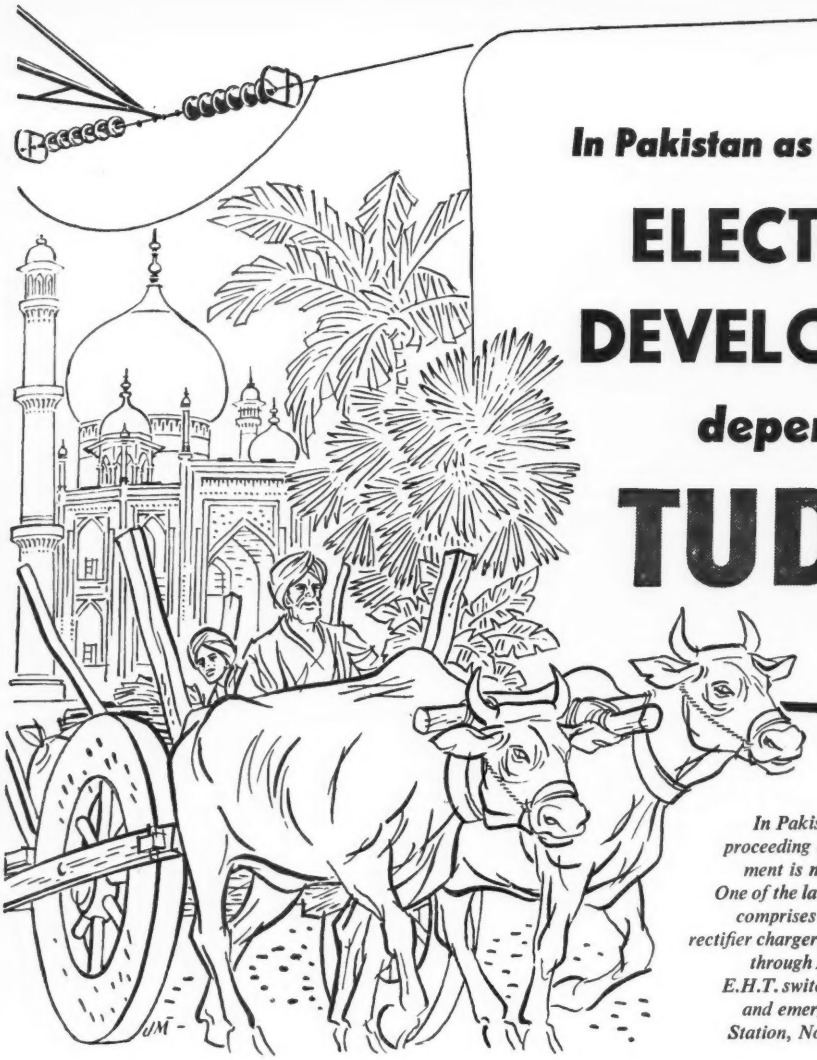

In Pakistan as in Great Britain

ELECTRICAL DEVELOPMENT

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TUDOR

In Pakistan, where electrification is proceeding apace, Tudor Battery equipment is making its contribution. One of the latest Tudor export shipments comprises a 230 volt battery and combined rectifier charger/D.C. switchboard supplied through Ferguson Pailin, Ltd. for E.H.T. switchgear operating, indication and emergency duties in Dargai Power Station, North West Frontier Province.

FOR OVER FIFTY YEARS The Tudor Accumulator Company has specialised in the manufacture of batteries for switchgear operation, indication and emergency duties in power stations and substations; and Tudor Batteries have played a large part in the recent expansion of electricity supply in Britain. Wherever they are in service, Tudor Batteries are noted for their outstanding reliability and low maintenance cost under all conditions.

Tudor engineers will be pleased to prepare a specification of the most economical battery scheme to meet your requirements. There are Tudor agents in most parts of the world.

Tudor BATTERIES

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and retail dealers, and repairers of artificial lighting apparatus, electrical plant, machinery, radio and television sets and accessories, etc. Subscribers: E. R. Watkins and D. J. Bryant. Solicitors: Jones & Middleton, Chesterfield.

Trenton Television, Ltd.—Registered 5th May. Capital £2,000. To acquire the business of a radio, electrical and television engineer carried on by H. F. Grainge at 29, Kilburn Lane, W.9. Directors: H. F. Grainge, Mrs. Joan Grainge and Miss Anne Denton. Secretary: P. Beeston. Regd. office: 11, Tennyson Mansions, Queens Club Gardens, W.14.

Sonicmill, Ltd. — Registered 10th April. Capital £50,000. Manufacturers of and dealers in boilers, turbines, winding engines, haulage plant, dynamos, motors, electrical plant and equipment, etc. Secretary: G. F. Pyle. Regd. office: 319, High Holborn, W.C.1.

A. P. Last & Sons, Ltd.—Registered 11th May. Capital £2,000. Electrical engineers, electricians, mechanical engineers. Directors: A. P. Last, Mrs. Marjorie J. Last and B. P. Last. Regd. office: 237, Westbourne Grove, W.11.

Burkill's for Wireless, Ltd.—Registered 28th May. Capital £1,000. To acquire the business of radio and electrical engineers and contractors now carried on by the administrators of the estate of C. W. Burkill (deceased) at 93, Carlton Street, Castleford, Yorks, as "Burkill's for Wireless." Directors: Mabel Burkill, Phyllis C. Morgan and Mildred Bailey-Smith. Regd. office: 93, Carlton Street, Castleford, Yorks.

M. J. Parsons (Bournemouth), Ltd.—Registered 31st May. Capital £1,500. General, precision, constructional and mechanical engineers, electrical engineers and general electrical installation contractors, etc. Directors: L. J. Wade, Kathleen E. Wade, Margaret E. Wattam and S. M. Burrows. Regd. office: 183, Ashley Road, Parkstone, Dorset.

Electro Mechan-Heat, Ltd.—Registered 24th April. Capital £1,000. Electrical, mechanical, general, radio, television and telephonic engineers and contractors, etc. Regd. office: Lower Teddington Road, Hampton Wick, Middlesex.

Increases of Capital

Ericsson Telephones, Ltd.—Increased by £600,000, in 5s ordinary shares, beyond the registered capital of £700,000.

Burgess Products Co., Ltd.—Increased by £100,000, in 5s ordinary shares, beyond the registered capital of £200,000.

Arcolectric (Switches), Ltd.—Increased by £49,900, in £1 shares, beyond the registered capital of £100.

Johnson & Co. (Bradford), Ltd.—Increased by £3,000, in £1 ordinary shares, beyond the registered capital of £3,000.

Evenlite Tube Lamp Developments, Ltd.—Increased by £9,000, in 5s ordinary shares, beyond the registered capital of £1,000.

Grierson, Ltd.—Increased by £20,000, in £1 ordinary shares, beyond the registered capital of £10,000. Richard Crittall & Co., Ltd., hold a majority of the issued shares.

Elliott Brothers (London), Ltd.—Increased by £250,000, in 5s ordinary shares, beyond the registered capital of £500,000.

Art and Utility

THE twelfth report of the Royal Fine Art Commission (for 1953) was published last week (Cmd. 9177, H.M. Stationery Office, 6d). It contains a long list of matters which came before it during the year, including the proposed television tower at Sydenham; power stations at Belvedere (Kent), Castle Donington (Notts), Drakelow (Derbys.), Greenwich, Machen (Mon.), Marchwood (Hants), North Wilford (Notts), South Denes (Great Yarmouth), Stella (Co. Durham) and Willington (Derbys.); and street lighting at about twenty places.

At Machen the Commission opposed the erection of a power station in one of the most attractive parts of Monmouthshire and the Minister of Fuel and Power has refused his consent. The Commission's opposition to the proposal for South Denes, however, "has failed to convince the authorities that irreparable damage will be done to the amenities of Great Yarmouth." The Commission goes on to say:—"There seems to be a tendency to believe that bad siting can be remedied by impressive elevations or elaborate brickwork; it would be unfortunate if such a view were generally accepted."

It is noted with satisfaction that further progress has been made in the actual design of power stations; the Committee of Inquiry into Economy in the Construction of Power Stations has endorsed the Commission's preference for "direct architectural expression." A notable development is the design for the new station at Willington, where most of the plant has been left exposed but carefully planned and detailed, to produce an effective group of structures. Similarly in the design of gasworks a more direct approach is now beginning to be made.

Reference has been made in earlier reports to the unsatisfactory nature of street lighting in some places. The situation is said to remain "profoundly disturbing." It is thought that with the easing of the steel supply position and the development of improved types of standard, encouraged by the Council of Industrial Design, it should seldom be necessary to make use of the heavier concrete columns and brackets that were introduced immediately after the war.

In many cases, too, the scale of the buildings calls for a reduction in height below the 25ft required by current regulations and further technical research is called for to enable the necessary standard of illumination to be maintained with the shorter lamp posts.

Royal Highland Show

A NUMBER of new electrical appliances for use on the farm, in the market garden and in rural areas generally were to be seen at the Royal Highland Show at Dumfries on a stand arranged by the South West Scotland Electricity Board in conjunction with the E.D.A., the South East Scotland Electricity Board and the North of Scotland Hydro-Electric Board. Among these was the Martin Cultivator Co.'s 1 h.p. "Comet Minor" automatic hammer mill outfit, especially suitable for the small pig and poultry farmer. Hitherto the smallest mill available on the British market has been 3 h.p. Also on show for the first time was the "Brent" stainless steel "Electric Foster Mother" made by the Churn Co. A small Sumo submersible pump will deliver approximately 1,000 gal of water for one kWh of electricity. In the Horticultural Section, there is an enclosed propagating bench which can provide controlled propagating temperatures in a cool house without the expense of raising the air temperature in the whole house. The bench is made by the Agricultural Supplies Co., the main voltage cables by the G.E.C., and thermostat by Unity. Of interest to the gardener with extensive lawns is the "Vergemaster" marketed by the Tarpen Engineering Co., Ltd.

Mr. J. S. Pickles, chairman, South West Scotland Electricity Board, Mrs. Pickles and Mr. W. Wills, manager, Dumfries and Galloway Sub-Area, at the electricity stand at the Royal Highland Show

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 11th August from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

30858. Electric & Musical Industries, Ltd.—Photo-sensitive or secondary electron emitting surfaces. 6th December, 1951. (713430.)

1951

4139. British Telecommunications Research, Ltd.—Magnetic amplifiers. 7th February, 1952. (713433.)

8453. General Electric Co., Ltd., and Gallizia, E.—Vapour electric arc convertors. 19th June, 1952. (713440.)

11487. Taylor, E. H.—Thermally controlled electric switches. 16th May, 1952. (713443.)

14320. Automatic Telephone & Electric Co., Ltd. — Electromagnetically-operated relays. 9th June, 1952. (713444.)

16710. Hofgaard, R.—Electrical relay calculating machine. 13th July, 1951. (713338.)

16928. National Research Development Corporation.—Piezo-electric transducers. 17th October, 1952. (713339.)

18228. General Electric Co., Ltd., and Williams, H. W.—Electrical control apparatus. 18th July, 1952. (713452.)

20371. English Electric Co., Ltd.—Electric hotplates. 22nd August, 1952. (713454.)

21104. Parmiter, Hope & Sugden, Ltd.—Electric fuses. 4th September, 1952. (713456.)

21360. Smith & Sons (England), Ltd., S.—Electric generators. 24th September, 1952. (713343.)

22856. Pye, Ltd.—Prevention of coronary discharge in high-tension electrical devices. 31st October, 1952. (713458.)

24356. General Electric Co., Ltd., and Bayliss, A. J.—Apparatus for converting variable quantities into electric pulse code signals. 20th October, 1952. (713347.)

29190. Philips Electrical Industries, Ltd.—Electric lampholders. 13th December, 1951. (713465.)

30304. Western Electric Co., Inc.—Pulse circuits using transistors. 28th December, 1951. (713359.)

1952

1518. General Electric Co., Ltd., Fisher, S. F., and Peddle, E. A. R.—Electronic counter or like circuits including a plurality of gas-filled discharge valves. 13th January, 1953. (713475.)

1521. General Electric Co., Ltd., Bayliss, A. J., and Peddle, E. A. R.—Multi-channel electric pulse code modulation signalling. 7th January, 1953. (713476.)

1545. Siemens Schuckertwerke Akt.-Ges.—Soldering appliances. 18th January, 1952. (713566.)

3170. English Electric Co., Ltd.—Electric motor control systems. 6th February, 1953. (713483.)

5021. Schilling, A. H.—Electrical convertors employing rolling contact arrangements. 26th February, 1952. (713364.)

5687. Compagnie Générale d'Electricité.—Arrangements for securing electrical insulators. 4th March, 1952. (713365.)

6604. Raytheon Manufacturing Co.—Electric switches for echo ranging devices. 13th March, 1952. (713366.)

6852. Standard Telephones & Cables, Ltd.—Capacitors. 13th March, 1953. Addition to 693062. (713572.)

11310. Chase-Shawmut Co. — Current-limiting electric fuses. 5th May, 1952. (713495.)

11714. Moser-Glaser & Co. Akt.-Ges.—Electric transformer arrangements. 8th May, 1952. (713373.)

12104. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 13th May, 1952. (713375.)

13010. British Insulated Callender's Cables, Ltd.—Manufacture of lead alloys. 21st May, 1953. (713283.)

13579. General Electric Co., Ltd., Barsdorf, L. W., and Polgreen, G. R.—Electrical signalling devices. 28th May, 1952. (713591.)

14467. Siemens & Halske Akt.-Ges.—Electric disc type condensers. 9th June, 1952. (713499.)

15949. Cordwell, F. J., and Pepper, B.—Electric lamp standards. 22nd June, 1953. (713378.)

16295. Elektrokemisk Aktieselskap.—Electric smelting furnaces and smelting plant and processes employing such furnaces. 27th June, 1952. (713506.)

16665. Sperry Corporation. — Electromagnetic apparatus. 2nd July, 1952. (713289.)

17078. Compagnie Générale de Télégraphie sans Fil.—Travelling wave magnetron tubes. 7th July, 1952. (713595.)

17525. Western Electric Co., Inc. — Methods of controlling the electrical characteristics of semi-conductive bodies. 11th July, 1952. (713597.)

17679. Foote Mineral Co.—Welding electrode coating and method of making the same and electrodes coated therewith. 14th July, 1952. (713381.)

18104. Boehringer Ges. Geb.—Electric pre-selecting switch devices, particularly for machine tools. 17th July, 1952. (713383.)

19526. Western Electric Co., Inc.—Electric signal transmission circuits employing transistors. 1st August, 1952. (713387.)

19671. British Thomson-Houston Co., Ltd.—Electric motors. 15th June, 1953. (713388.)

19831. Hartley Electromotives, Ltd., Evans, R., and Petrie, J. D.—Electrical junction boxes. 22nd July, 1953. (713389.)

20225. Bosche Ges., R.—Regulating and switching systems for direct-current generators for electrical systems on vehicles. 12th August, 1952. (713392.)

20787. Standard Telephones & Cables, Ltd.—Manufacture of electrical capacitors. 19th August, 1952. (713605.)

21784. Maschinenfabrik Hasenclever Akt.-Ges.—Method of operating electrically heated forging machines and a machine to carry out the method. 29th August, 1952. (713292.)

22194. Kennedy, J. R., and King, H. L.—Means for the inspection of brush sparking in dynamo-electric machines. 6th August, 1953. (713608.)

24180. Philips Electrical Industries, Ltd.—Methods for breaking an annular core of ferromagnetic material. 26th September, 1952. (713399.)

25022. Telefonaktiebolaget L. M. Ericsson.—Device for balancing or measuring the magnitude of an impedance. 6th October, 1952. (713301.)

25861. Licentia Patent-Verwaltungs Ges.—Dry-plate rectifier with an intermediate layer consisting of a chemical compound. 15th October, 1952. (713403.)

25903. Soc. Francaise de l'Electro-Resistance.—Watertight potentiometers. 15th October, 1952. Addition to 684067. (713613.)

26102. Standard Telephones & Cables, Ltd.—Electric pulse communication system. 17th October, 1952. (713614.) 26103. Pulse transmission through inductive circuits. 17th October, 1952. (713615.)

26558. Siemens & Halske Akt.-Ges.—Selectors of the telecommunications type. 22nd October, 1952. Addition to 704036. (713616.)

26607. Sundstrand Magnetic Products Co.—Magnetic separators. 23rd October, 1952. (713299.)

27616. Philips Electrical Industries, Ltd.—Circuit arrangements for synchronizing an oscillator to a control-oscillation. 3rd November, 1952. (713407.)

29788. Philips Electrical Industries, Ltd.—Devices for separating synchronizing pulse and signal pulses in pulse-code modulation systems. 25th November, 1952. Addition to 698708. (713620.)

29794. Standard Telephones & Cables, Ltd.—Manufacture of electrical capacitors. 25th November, 1952. Addition to 713605. (713621.)

31953. Kolster-Brandes, Ltd.—Tuning of electrical circuits. 17th December, 1952. (713310.)

1953

33167. Weil, W. M.—Electrolytic cell. 5th February, 1951. Divided out of 713432. (713518.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 9th July:—

No. 703,657 (design), Class 7. Electrically driven rotary tools and tools for use therewith.—A. Rüggeberg and H. Rüggeberg, trading as August Rüggeberg O.H.G., Marienheide-Rheinland, Germany. Address for service, c/o Jensen & Son, 77, Chancery Lane, London, W.C.2.

H.M.V. No. 717,042, Class 7. Domestic electric food mixing machines.—The Gramophone Co., Ltd., Blyth Road, Hayes, Middx.

IMPEX. No. 727,487, Class 7. Dynamos and parts. — Süddentache Metallwerke G.m.b.H., Baden, Germany. Address for service, c/o Edward Evans & Co., 14–18, High Holborn, London, W.C.1.

No. 708,131 (design), Class 9. Electrical instruments and apparatus; and scientific, nautical, surveying, photographic, cinematographic, optical, weighing, measuring and checking (supervision) instruments and apparatus.—American Radiator & Standard Sanitary Corporation, Pittsburgh, U.S.A. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

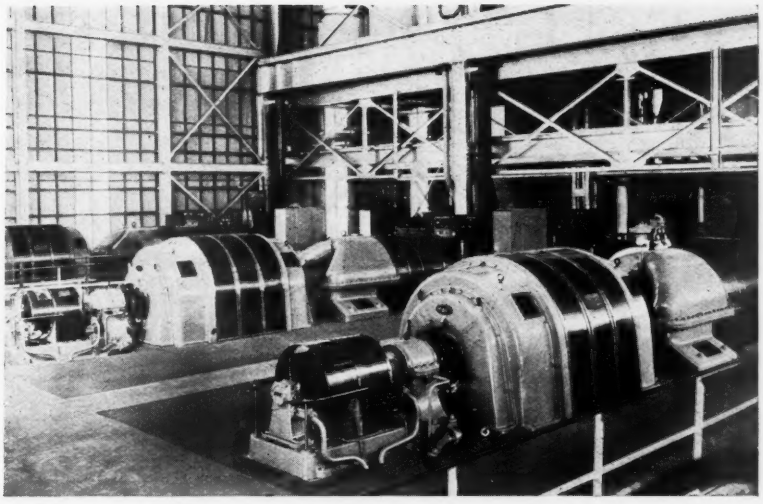
PYE. No. B719,323, Class 9, and No. B719,324, Class 11. Domestic electrical appliances and parts.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

CHEMEX. No. 727,936, Class 9 Coffee percolators (electrically heated).—Chemex, Ltd., New York, U.S.A. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.

LEOCAST. No. 728,302, Class 9. Electrical apparatus and parts all encased in solid insulating material.—Lion Switchgear, Ltd., 12, The Green, Richmond, Surrey.

LUMENETTE. No. B727,448, Class 11. Lighting installations and parts and fittings included in Class 11 for such goods.—Siemens Electric Lamps & Supplies, Ltd., Caxton House, Tothill Street, Westminster, S.W.1.

GENERATION AND DEVELOPMENT



G.E.C. 7,500 kW turbo-alternators in the Howard power station, Queensland

Gas and Electricity in North West

The *Quarterly Bulletin* of the North Western Gas Board says that comparison of the progress of domestic gas and electricity sales since 1950–51 shows that in the North West the general fall in consumers' purchasing power during the 1952 textile recession checked the rise of domestic electricity sales, and in 1952–53 sales of both fuels were about 1 per cent less than in 1950–51. But in the country as a whole, where the influence of changes in industrial activity is less pronounced, there was a steady rise in domestic electricity sales, while gas sales showed a downward trend. For the twelve months up to the end of March, 1954, electricity sales figures are not yet available, but figures of total electricity sent out show a rise of 6·9 per cent for all Boards and 7·8 per cent for the North Western Electricity Area. This compares with a fall of 0·5 per cent in total gas sales in the North Western Area.

Improving Minehead Supply

When he visited the Minehead District last week Mr. S. F. Steward, chairman of the South Western Electricity Board, who was accompanied by the district manager (Mr. A. H. Short) and the district engineer (Mr. F. H. Crocombe), saw the progress of a £25,000 scheme to extend a 33 kV transmission line into the town and provide a new bulk supply point. This is necessary because the demand in the Minehead District has nearly trebled since 1948.

S.E.B. Tariff Modification

Following representations by the Electricity Consultative Council the Southern Electricity Board has varied its standard tariffs so that the bedrooms and private sitting-rooms in old people's homes, children's homes, hotels, colleges and boarding schools now come under the domestic instead of the commercial tariff.

Objection to Staythorpe Extensions

Newark and Southwell Rural District Councils are objecting to the proposed extensions to the Staythorpe power station on the grounds that the buildings will dominate the rural scene over a wide area and spoil the amenities of the surrounding land.

Network Modernization

The North Eastern Electricity Board is to take over the Shotton (Co. Durham) electricity network from the National Coal Board next year. It is proposed to spend over £100,000 improving the network to bring it up to modern standards.

Uganda-Kenya Power Link

The Nairobi correspondent of the *Financial Times* reports that the Kenya Power Co., registered in Nairobi, has been formed to purchase a bulk supply of electricity from Uganda for a period of 50 years for distribution in East Africa. It is proposed to take power from Owen Falls to Nairobi, necessitating the construction of a transmission line 260 miles long over mountain and jungle country. The estimated cost is £3,300,000. In places the line will be carried 9,000ft above sea level.

The newly erected Dhekelia power station was visited recently by the Governor of Cyprus, Sir Robert Armitage, K.C.M.G., M.B.E. In this photograph Sir Robert is being introduced to Mr. Sims (John Thompson Boilers). Others in the group include, from left to right, Messrs. C. A. Henderson (Metropolitan-Vickers), R. F. Hook (British Insulated Callender's Construction Co.) and Mr. T. S. C. McIlwain (secretary and chief accountant, Electricity Authority of Cyprus)

First Luichart Set Started

The first generator of the North of Scotland Hydro-Electric Board's Luichart power station in Ross-shire turned round for the first time on 22nd June. Sir Hugh Mackenzie, deputy chairman of the Board, pulled the lever which admitted water to the machine and set it in motion. The generator, which has a capacity of 12,000 kW, has still to undergo extensive tests before it is placed in full operation. A second similar generator in the station is nearing completion.

The Luichart station is one of four power stations in the Board's Glascarnoch–Luichart–Torr Achilty scheme, the main development of the hydro-electric resources of the River Conon valley, which will have a total capacity of about 65,000 kW and an annual output of about 290 million kWh. Altogether there will be in the valley of the River Conon six generating stations with an installed capacity of 107,000 kW.

Queensland Plant Extensions

The Wide Bay Regional Board, Queensland, supplies electric power for an area of over 16,000 sq miles, with a population of 92,000. Power demand arises mainly from irrigation plant and to a lesser extent from coal mining and shipbuilding. The Board's main generating unit is the Howard power station on the Burrum River. This will have an ultimate capacity of 52,500 kW, the first section now in full operation including three 7,500 kW turbo-alternators and a 750 kW house set, all supplied by the General Electric Co., Ltd.

The three main units generate at 11 kV, three-phase, 50 c/s, 0·8 power factor when running at 3,000 r.p.m. The alternators follow the company's standard design and use a closed air cooling system, the fans being mounted on the rotor shaft. Each alternator is direct-coupled to a single-casing high-pressure turbine. Steam is supplied at 400 lb/sq in, 750 deg F, and the sets are designed to operate on a vacuum of 28·25 in (30in bar).

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—MELBOURNE.—25th August. State Electricity Commission of Victoria. Seven 750 kVA, 3·3 kV transformers and spares for Yallourn power station. (E.S.B. 15238/54. Ten/9691.)*

BRISBANE.—3rd September. City Council. Six 7,500 kVA transformers. (E.S.B. 15194/54. Ten/9683.)*

SYDNEY.—26th July. Electricity Commission of New South Wales. 30 MVA 132 kV transformers. (E.S.B. 15866/54. Ten/9742.)*

Belfast.—19th August. Corporation. Four 630,000 lb/hr boiler feed pumps and one 650,000 lb/hr boiler feed pump for West power station. (See this issue.)

31st July. Electrical installation at St. Patrick's Training School. J. R. W. Murland, consulting engineer, 13, Wellington Place.

Cardiff.—8th July. Corporation Transport Department. Underground cables for trolley-bus extension scheme. (See this issue.)

Cumberland.—14th July. County Council. Electrical installations at St. John's and St. Michael's Schools, Workington. J. H. Haughan, county architect, 15, Portland Square, Carlisle.

Egypt.—CAIRO.—26th August. Ministry of War. Radio equipment. (E.S.B. 15772/54. Ten/9727.)*

Midlothian.—19th July. County Council. Street lighting installation at Newton Grange. (See this issue.)

New Zealand.—AUCKLAND.—16th July. Auckland Electric Power Board. Six 450 kVA 3-phase transformers. (E.S.B. 15601-2/54. Ten/9696-7.)* H.v. cable. (E.S.B. 15179–80/54 Ten/9698–9.)*

Persia.—TEHRAN.—20th July. Procurement Office USOM/1. Thirty diesel-electric generators. (E.S.B. 15249/54. Ten/9665.)*

South Africa.—JOHANNESBURG.—21st July. Stores Department, South African Railways. P.i. electric cables. (E.S.B. 15763/54. Ten/9722.)*

19th August. Union Tender and Supplies Board. Seven electrically driven pumps complete with motors, etc. (E.S.B. 15278/54. Ten/9667.)*

CAPE TOWN. 23rd July. Provincial Administration, Cape of Good Hope. Scientific equipment including electrical apparatus. (E.S.B. 15682/54. Ten/9723.)*

Uruguay.—MONTEVIDEO.—Ministerio de Salud Publica. X-ray apparatus and accessories. (E.S.B. 15405/54. Ten/9661.)* Apparatus and accessories for cardiology. (E.S.B. 15388/54. Ten/9685.)*

Wiltshire.—5th August. County Council. Electrical installation in new grammar school at Wessington, Calne. (See this issue.)

ORDERS PLACED

Southport.—Estates Committee. Recommended. Electrical installations in 96 houses on the Canning Road, Lytham Road, and Shaws Road estates (£1,834).—Mason Bros.

Electrical installations in nine service shops at the Brinnington Neighbourhood Unit (£924).—Jones, Morris & Co.

Lighting Committee. Recommended. Class "A" street lighting, Schemes III, IV and V (£10,802).—Wardle Engineering Co.

Stretford.—Town Council. "Trafford II" lanterns and steel poles for improved Group "A" street lighting (£3,834.)—Metropolitan-Vickers.

Wallasey.—Works Committee. Recommended. Street lighting in Church Road, Brighton Street and King Street:—Sixty type Z.9425 lanterns complete with lamps (£19 6s 2d per unit).—G.E.C. Pre-stressed concrete columns (from £21 2s to £21 18s each).—Stanton Ironworks Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Birmingham.—Secondary school, Wythall (£124,000); S. T. Walker, architect, 83, Suffolk Street, Birmingham.

Blackburn.—Second stage of extensions to Technical College (£189,600); Willink & Dod, architects, Cunard Buildings, Liverpool.

Boscombe.—Pathological laboratory for Royal Victoria Hospital (£27,000); Maurice G. Bland & Son, consulting engineers, 36, Chartfield Avenue, London, S.W.15.

Bristol.—Houses (30), Headley Park; Cunningham & Gibaud, surveyors, All Saints House, Exchange.

Chesterfield. — Offices, warehouse and garage, Sheffield Road, for Chas. Mason & Co.; A. L. Heath, architect, Crompton Chambers, Dale Road, Matlock.

Coventry.—Rebuilding Paynes Road Works for Singer Motors, Ltd.; Hurley & Robinson, architects, Cadogan Chambers, 6, Cherry Street, Birmingham.

Rebuilding main transport offices in Harnall Lane; D. E. E. Gibson, city architect, Bull Yard, off Warwick Row.

Darlaston. — Dwellings (28), Foundry Street and Park Street redevelopment, for U.D.C.; John P. Osborne & Son, architects, 95, Colmore Row, Birmingham, 3.

Doncaster. — Extensions to Infectious Diseases Hospital; Roger Preston & Partners, consultants for heating and lighting, 15, North Audley Street, London, W.1.

Eastbourne.—Project for establishment of new Winter Gardens (£265,000); R. Williams, borough surveyor, 2–4, Saffrons Road.

East Sheen.—Flats (72), and 12 garages at Priests Bridge, Upper Richmond Road, for Barnes B.C.; W. R. Shepherd, borough surveyor, Municipal Offices, Sheen Lane, London, S.W.14.

Horwich.—Research station in Chorley New Road; J. W. Roberts, Ltd., asbestos manufacturers, Canal Road, Leeds, 12.

Ilfracombe.—Dwellings (22), Slade Valley Road; U.D.C. surveyor.

London. — BERMONDSEY. — Dwellings (57), Roseberry Road site; Ashley & Winton Newman, architects, 3, Verulam Buildings, Gray's Inn, W.C.1.

CITY.—Offices, Whitefriars Street; *News of the World*, Bouverie Street, E.C.4.

Manchester.—Extensions to factory at Altrincham Road, Northenden, for H. G. Allcard & Co.; J. Henry Sellers & Son, architects, 78, King Street, Manchester.

Erection of warehouse, offices and bank (stage 1) at Leestone Road, Northenden, for J. Smylie & Sons, Ltd.; W. T. Gunson & Son, architects, 10, Marsden Street, Manchester.

Newcastle-on-Tyne.—New St. Mary's Church, Kenton (£23,000); J. & W. Lowry, Corporation Street.

North Riding.—Fire station, Hill Hou estate, Richmond (£18,615); county architec County Hall, Northallerton.

North Shields.—R.C. church at Chirto T. Curry & Son, 7, Meldon Street, Newcastl on-Tyne.

Northampton.—Secondary modern scho for girls (£139,626), extension of girls' gramm school (£70,000) and third phase of technic high school (£94,140); county architec Northampton.

Northumberland.—Aged people's hom Blyth; Austin Child, architect, Trini Buildings, New Bridge Street, Newcastle-o Tyne.

Aged persons' home, at Wallsend; Mauchle Weightman & Elphick, architects, Saville Ro Newcastle.

Child welfare centre, Bedlington; G. H Charlewood, architect, 14, Neville Stree Newcastle.

Paisley.—Showrooms, High Street; Jack son, The Tailor, Ltd., 94–102, Clayton Stree Newcastle-on-Tyne.

Portsmouth.—Factory additions, Rudmor Road; Portsmouth Steel Co., Ltd., corse steels, Rudmore, Portsmouth.

Poulton-le-Fylde.—Hotel at corner o High Cross Road; Fairbrother, Hall & Hedges, architects, Barclays Bank Chambers Blackpool.

Rotherham.—Factory extensions; A. J. Clifford, joinery manufacturer, Greasborough Street.

Sheffield.—Factory extensions, Andrew Street/Joiner Lane; Snow & Co., Ltd., machine tools, Stanley Street Works, 3.

South Shields.—Works additions for Shee Metal Works, Ltd., Wapping Street.

Southend-on-Sea.—Additions to London Road Municipal College (£175,000), and girls' high school at the Boulevard, Southchurch (£225,000); borough architect, Municipal Buildings, Clarence Road.

Stalybridge.—Garage and workshops at Tame Street for Stalybridge, Hyde, Mossley and Dukinfield Transport Board; P. Howard, architect, 88, Mosley Street, Manchester.

Stamford. — Wiring pre-war houses; borough surveyor, Town Hall, Stamford, Lincs.

Sudbury (Suffolk).—Additions to High School for Girls (£100,000); West Suffolk county architect, Westgate Street, Bury St. Edmunds.

Sutton Coldfield.—Extensions to works of Schweppes, Ltd., at Hansons Bridge Road; Batemans, architects, 18, Bennetts Hill, Birmingham, 2.

Tonyrefail.—Pithead baths and canteen at Coedley Colliery; N.C.B. Architect's Dept., Cambrian Buildings, Mount Stuart Square, Cardiff.

West Bromwich.—Factory, Colliery Road; Phillips Telescopic Taps, Ltd., 78, Victoria Street, Birmingham.

West Ham.—Multiple store and offices, seven shops, seven maisonnettes, and six flats, Church Street; borough architect and planning officer.

Weston-super-Mare. — Eight-classroom extension to grammar school; Kenneth Nealon, architect, 28, Orchard Street, Bristol.

Wisbech.—Rebuilding premises after fire, North Brink; Foster & Sons, timber merchants, 3, North Brink.

Witham.—Factory; Chamberlin, Powell & Bon, architects, 15, Sydney Mews, Fulham Road, London, S.W.3.

Wolverhampton.—Extensions to premises at Wolverhampton Road, Heath Town, for Jones Bros., Ltd.; H. G. Raybould, Wellcroft Street, Wednesbury.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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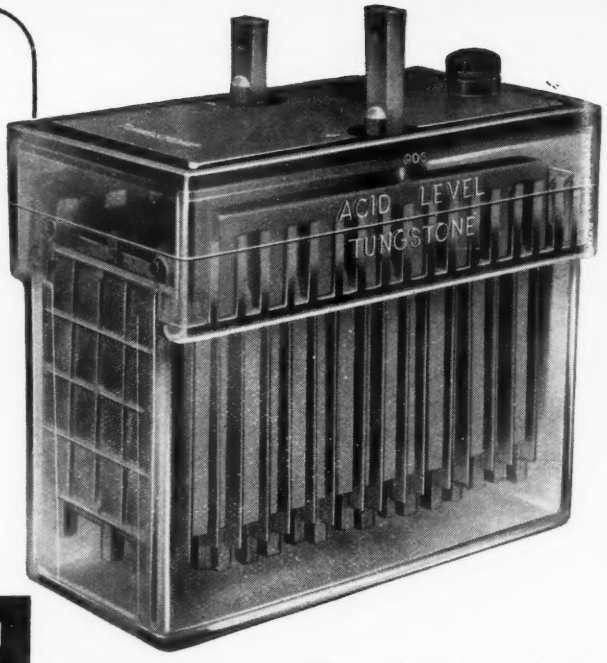

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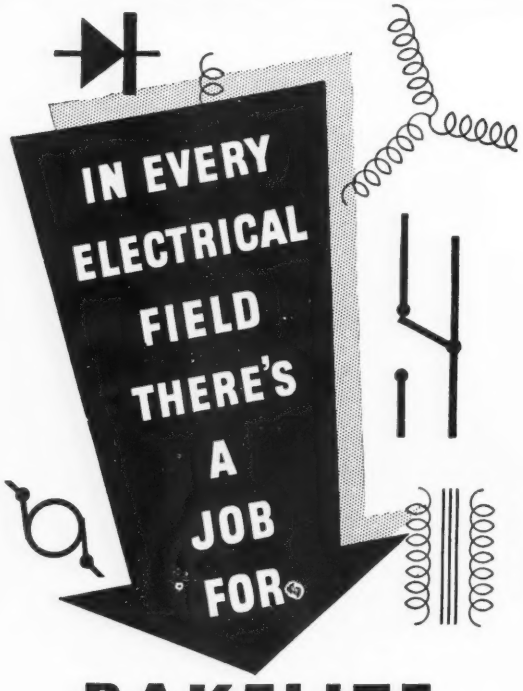

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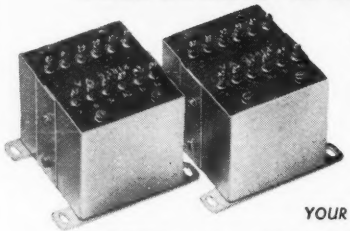

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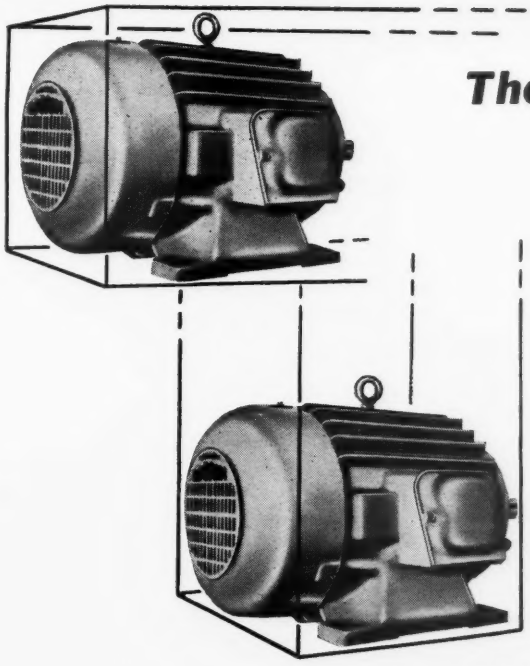

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7.5	1.82	2.58	3.16	3.65	4.47
10	1.58	2.24	2.74	3.16	3.88
15	1.29	1.83	2.24	2.58	3.16
25	1.00	1.41	1.73	2.00	2.45
50	.707	1.00	1.23	1.41	1.73
75	.578	.818	1.00	1.15	1.41
100	.500	.707	.866	1.00	1.23
150	.408	.575	.707	.818	1.00
200	.354	.500	.612	.707	.866
350	.268	.378	.463	.535	.655
500	.224	.316	.388	.447	.548
1,000	.158	.224	.274	.316	.388
1,500	.129	.183	.224	.258	.316
2,500	.100	.141	.173	.200	.245
5,000	.071	.100	.123	.141	.173
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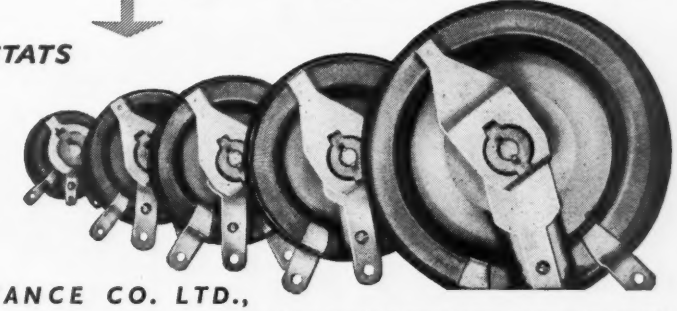

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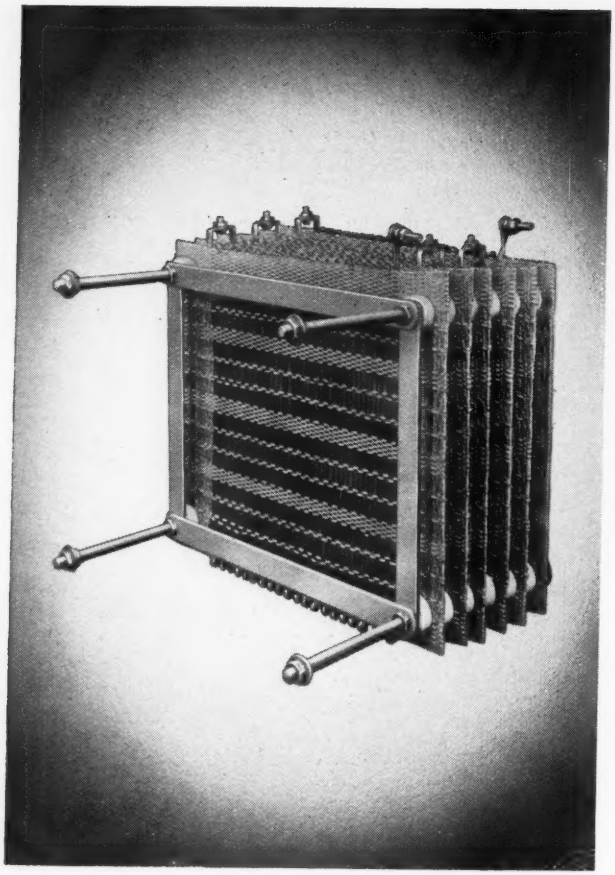

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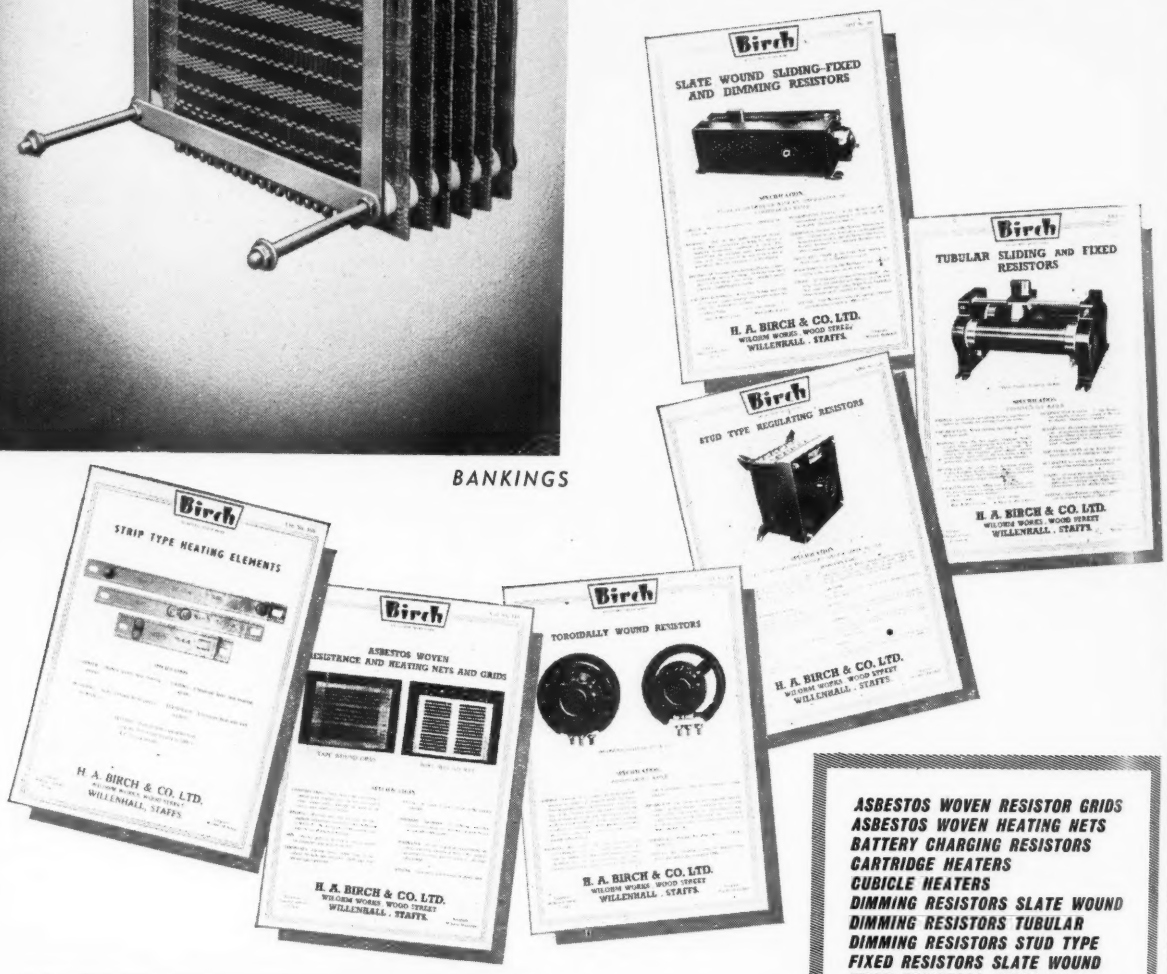
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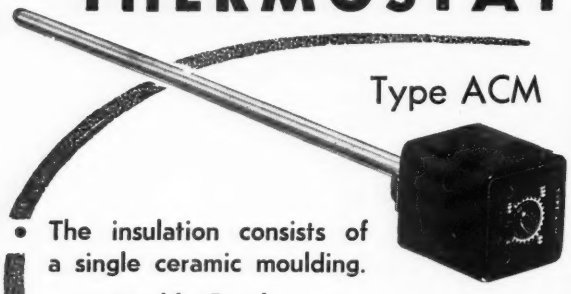

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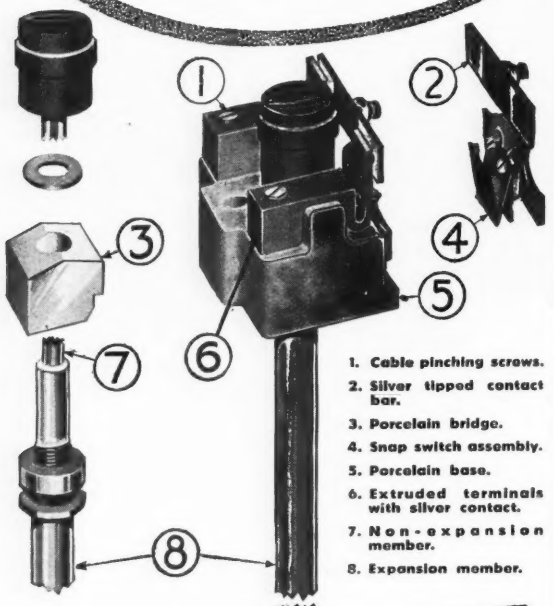

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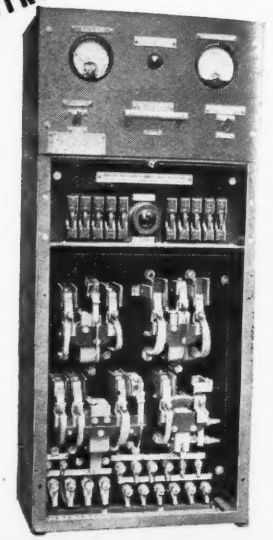

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Special inner plate inside top cover for conduit box fixing (2" centres).

Permits 36" Rise or Fall.

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Patented movement to adjust tension.

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at Aden Refinery

Flow, pressure, level and temperature in two 60,000 B.P.S.D. Crude Distillation Units are automatically controlled from two Central Control Desks at the new Anglo-Iranian Refinery. The process is illustrated on the desk by a coloured mimic diagram with indicators and controller adjustments mounted at appropriate points in the diagram, whilst the controllers themselves are mounted in banks in the wings of each desk. These controllers are connected by cables to the controller adjustments (Miniplaques). Each Miniplaque includes proportional, integral, derivative and desired value adjustments, also indication of measured value and controller output, together with hand/auto and service position controls.

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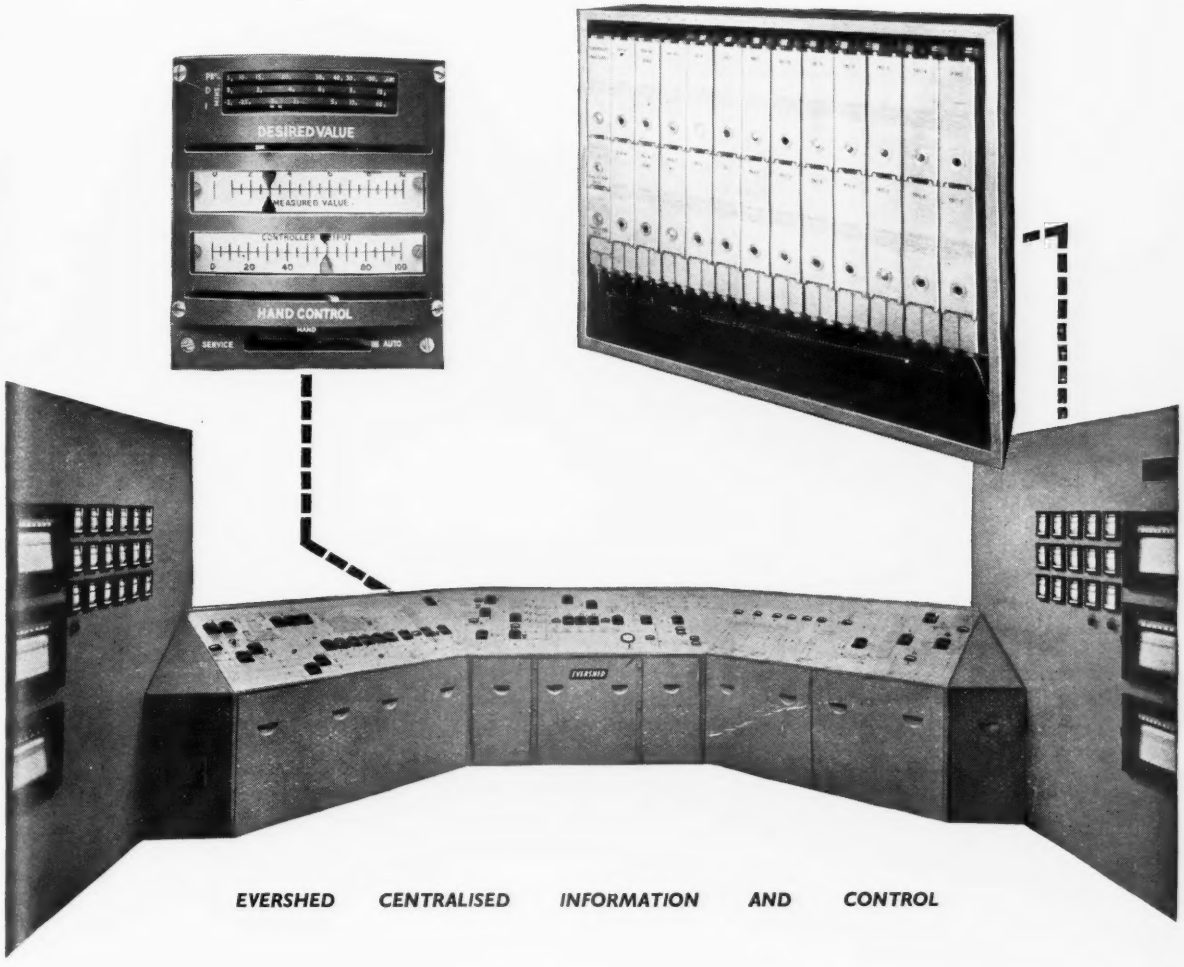

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6/143

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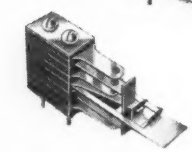
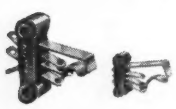
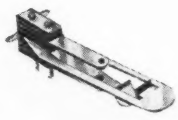
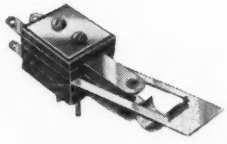




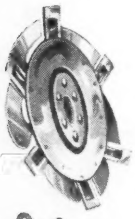


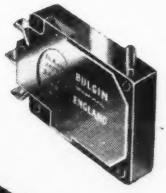


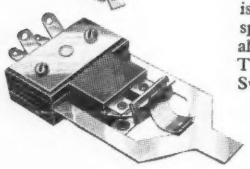
OPEN-BLADE TYPES

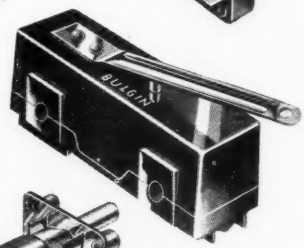
These are new-comers to the Bulgin range, and will be available at an early date. Manufactured to the same high standards as the enclosed models, they offer additional facilities when fitted into customers' own equipment. The 12-way ganged model (*illustrated below*) has been designed specifically for use in Electronic Organs, but can be adapted for other uses. The Sub-miniature model measures only $\frac{19}{64}$ in. high by $\frac{1}{4}$in. wide by 1in. long, and is ideal for use in equipment where space is at a premium, they are also designed for easy gangability. The range of Open-blade Micro-Switches covers many sizes and actuating pressures and characteristics.

Electrical Ratings for these types vary a great deal, but generally speaking they are the same as the enclosed models. Flexibility of customers' own requirements can be catered for.









ENCLOSED TYPES

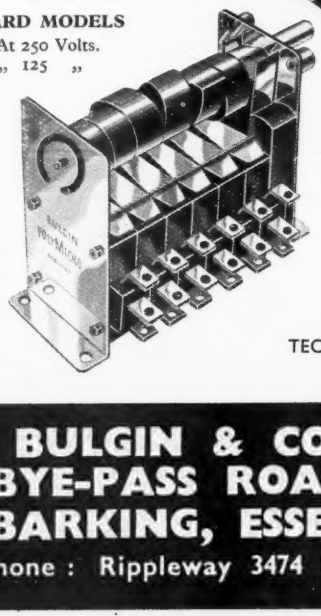
Bakelite moulded cases, stainless-steel or bakelite operating buttons, beryllium-copper operating springs and blades, and heavy pure-silver contacts. They are closed against dust, fluff and moisture, and are unaffected by vibration. Standard, Miniature and PolyMicro constitute the range of enclosed types, but many variations with different contacting arrangements and pressures, and in various electrical ratings, are available. The miniature "M" types have the advantage of inter-changeability of operating attachments.

MINIATURE "M" MODELS

1·5 Amp. At 250 Volts.
3 „ „ 125 „
6 „ „ 12 „

STANDARD MODELS

5 Amp. At 250 Volts.
10 „ „ 125 „



For information on other Bulgin products send for Catalogue 193/ER—free to trade.

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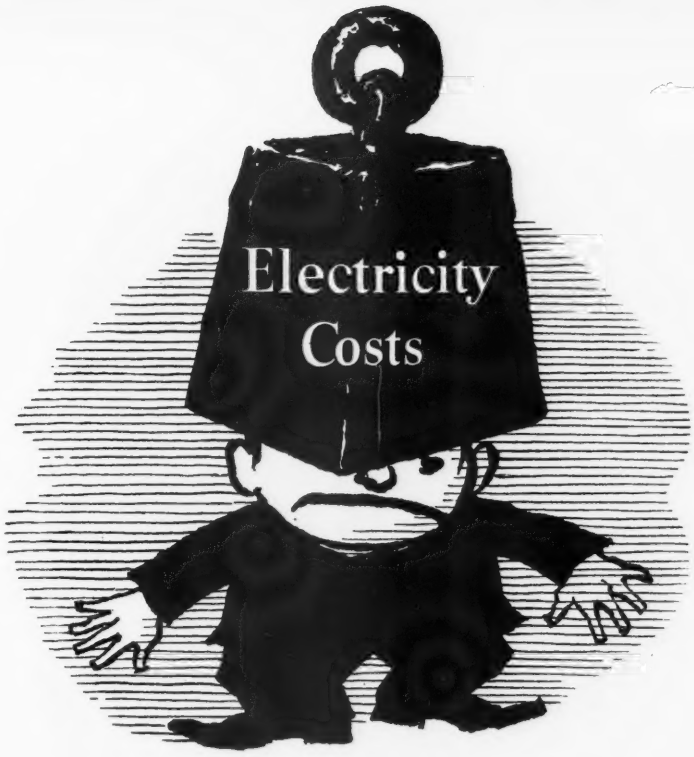

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Save on your electricity costs with

Power Factor Correction Capacitors

The installation of Dubilier Capacitors for power factor correction, effects such substantial saving in cost of power that the capital outlay is recovered in a short period of time. Occupying minimum floor space and requiring no maintenance, Dubilier Power Factor Correction Capacitors are absolutely reliable. Is there room for such improvement in *your* factory? Our engineers will carry out a full investigation of your present power factor and advise you without cost or obligation.

A small factory installed a Dubilier Capacitor to correct their power factor from 0.68 to 0.95, thus reducing their maximum demand from 28kVA to 20kVA.

Cost of Power

	£	s.	d
Before installing Capacitor ...	276	12	0
After installing Capacitor ...	228	12	0
Saving per annum	**48**	**0**	**0**

Approximate cost of Capacitor equipment £65.0.0 *thus paying for itself in little over a year.*

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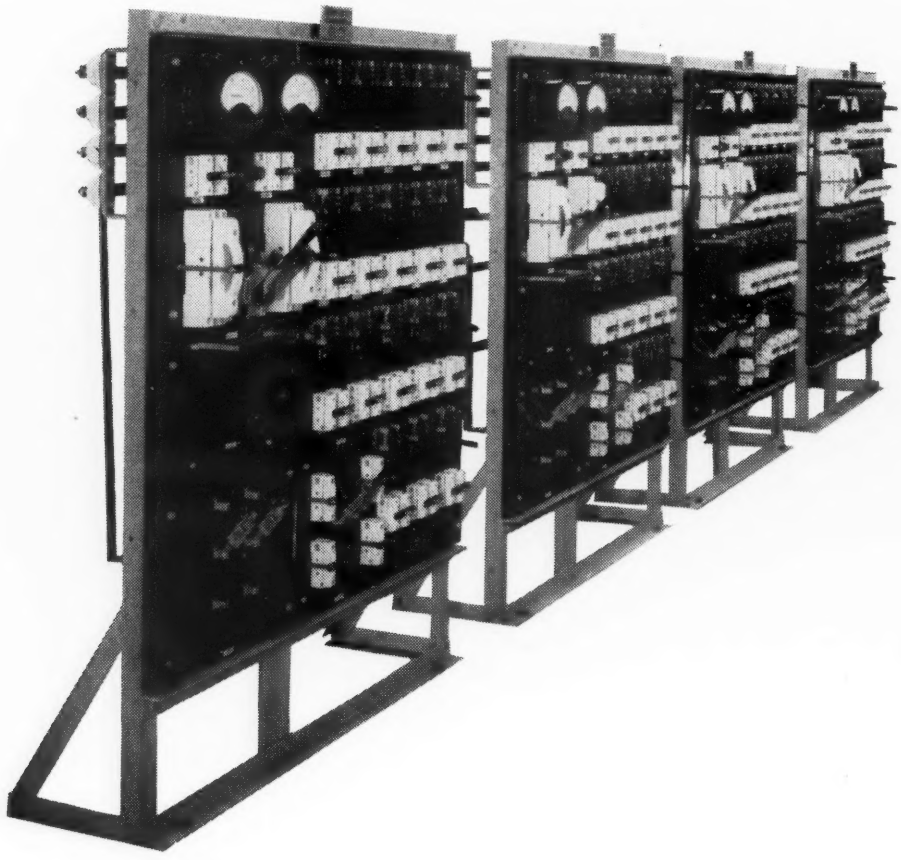
SWITCHBOARDS



OPEN TYPE as illustration
OIL IMMERSED UNIT TYPE, DEAD FRONT or
CUBICLE TYPE, also available.

The illustration shows a Switchboard incorporating Main and Feeder Circuits, and is a typical "VERITY" product backed by many years' experience in all fields of industry. We welcome your enquiries, our Sales Engineers are available to discuss your particular application.

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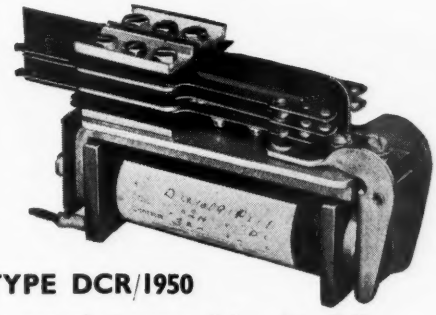

TYPE DCR/1950

A general purpose Relay for D.C. excitation. Switching capacity up to 8 amperes.

TYPE A.C.R/K

HEAVY DUTY A.C. RELAY
SWITCHING 35 amps. (up to 4 Poles or 2 Change over).

TROPICAL FINISH WHEN REQUIRED

Details of other types are available on request

MAGNETIC CONTROLS LTD.

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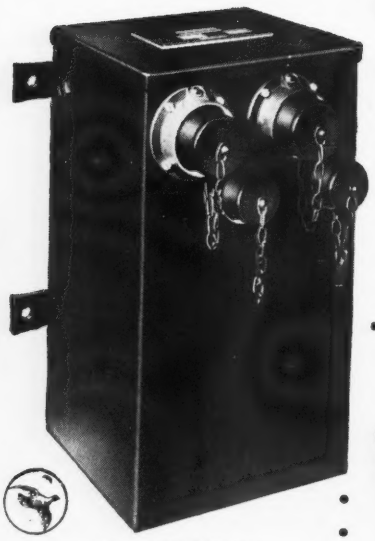
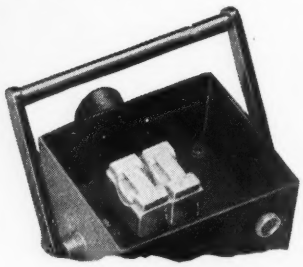
Partridge Low Voltage Transformer Units TYPE 2361



These low voltage units are available with back fixing straps for wall mounting, or fitted with carrying handle for use as portable units. (Ref. Nos. P/2361/1, etc.). They are designed for bench tool operation, lighting and similar industrial applications. The units are generally in accordance with BS.794/1938, and can be supplied with either 110v. or 25v. outlets or both. Windings have an earthed centre tap.



Above : Type 2361/5 (1,000 VA). Two 5 amp. and two 15 amp. outlet sockets.

Right: Interior view of Portable Unit Type P.2361/1 showing carrying handle and fuses.

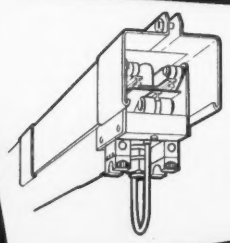
Outlet sockets are of protected type, two-pole in accordance with BS.196.

The number and rating of outlet sockets on each type of unit is given in table below.

REF. NO.	RATING	OUTLET SOCKETS	
		5 Amp.	15 Amp.
2361/1	150 VA	1	—
2361/2	250 VA	2	—
2361/3	500 VA	1	1
2361/4	750 VA	1	1
2361/5	1,000 VA	2	2

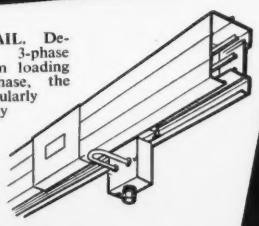
Partridge Transformers Ltd • Tolworth • Surrey

Telephone : ELMbridge 6737

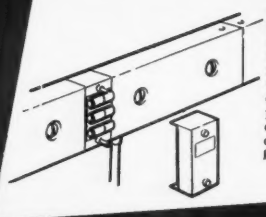


TROLLEY DUCT FEED RAIL. Consisting of one or more trolley collectors running on continuous conductor rails, the E.M.S. Trolley Duct avoids long, trailing leads on portable Tool installations, conveyor systems, moveable pendant lights, etc.

"UNIDUCT" FEED RAIL. Designed for 400 volt 3-phase supply, with a maximum loading of 100 amps per phase, the "Uniduct" is particularly suitable for high frequency tool installations on conveyor systems, small mobile cranes and hoists where bare conductors and trailing leads are dangerous.

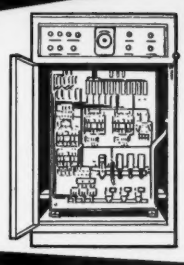


for industrial power users



"MINIBUS" DISTRIBUTION SYSTEM. A miniature Busbar distribution system designed for small industrial installations where total loading does not exceed 100 amps per bar, and the load of each machine does not exceed 30 amps, available for 3-phase 3- and 4-wire supplies.

CONTROL PANELS. This automatic control panel built for Imperial Chemical Industries illustrates the type of work we can undertake. Panels can be supplied complete or in skeleton form for building-in.



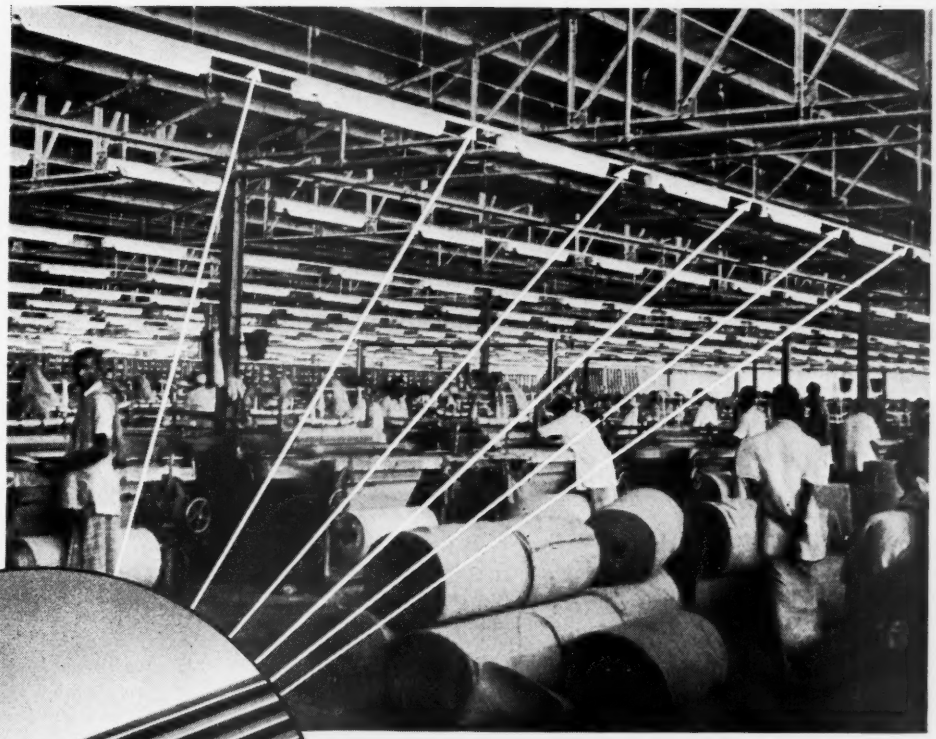
E.M.S ELECTRICAL PRODUCTS LTD

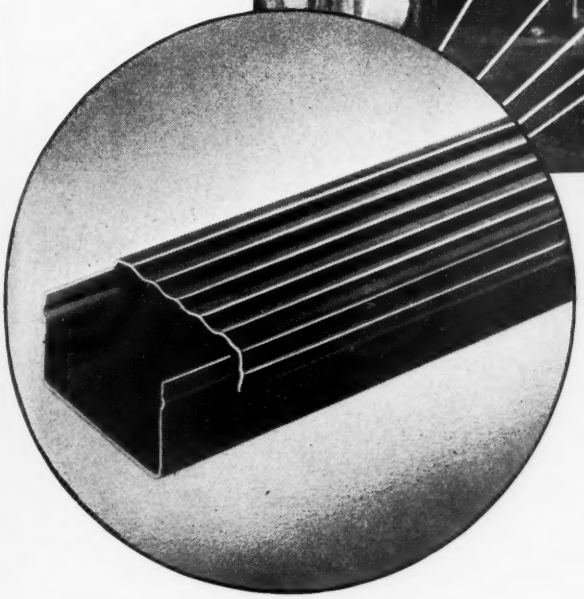
28, 32 THE BUTTS COVENTRY Tel: Coventry 61091 Grams: Dispatch Coventry

CHANNEL CONDUIT INSTALLED IN THE WORLD'S 3 LARGEST JUTE MILLS

In this view of the loom section of Adamjee No. 1 Mill B.T.H. fluorescent lighting fittings are seen attached to 2″ x 1″ Channel Conduit.

(Photograph reproduced by permission of Engineering Consultant, H. M. NIMMO, M.Sc., B.E., A.M.I.E.E.)





The Adamjee Mills at Narayanganj in the Dominion of Pakistan are claimed to be the largest of their kind in the world. Each of the three mills covers an area of about 500,000 sq. ft.

These mills are illuminated by more than 6,500 fluorescent fittings which are supported by 2″ × 1″ Channel Conduit. Altogether, some 150,000 feet of this cable trunking has been installed. It carries all the circuit wiring and has resulted in exceptionally low installation costs.

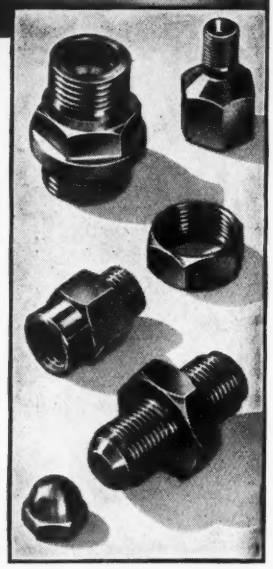
★ *Channel Spring Capped Conduit costs less to buy, install and maintain than any other form of cable trunking. For full information, write or phone for a copy of pamphlet R.A.15.*

Sizes stocked : 4″ × 4″, 4″ × 3″, 3″ × 3″, 3″ × 2″ 2″ × 2″, 2″ × 1″, 1″ × 1″ *and* 1″ × ½″.

CHANNEL "Spring Capped" CONDUIT

CHANNEL CONDUITS LTD., 11 VICTORIA STREET, LONDON, S.W.1. Telephone: ABBey 2027/8

For highest speed with absolute precision—specify



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Ever higher speeds demand ever greater precision—and British industry needs both if production is to be increased and costs reduced. McKechnie Brothers have developed a range of standard high-speed turning and screwing rods, including the popular **No. 4** and **YS**, all of which are guaranteed to combine the correct alloy and temper for maximum machine speeds and longest tool life. For full details of these and other MKB free machining rods please write to—

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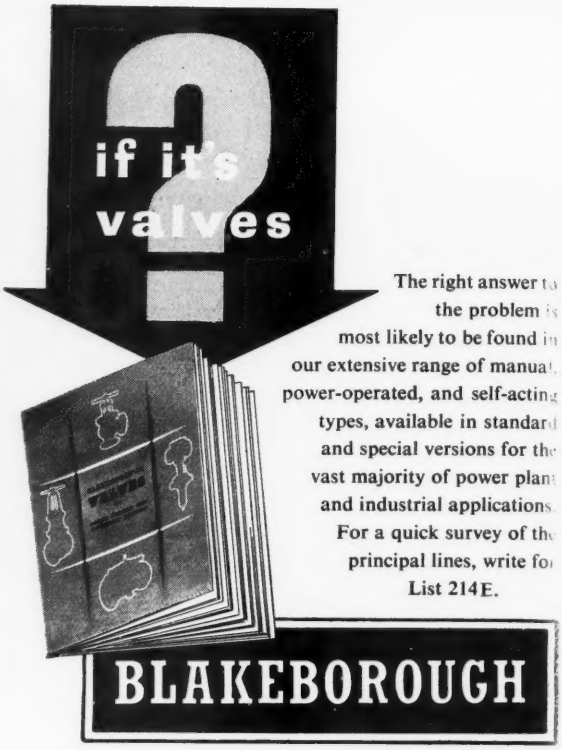
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?
The right answer to the problem is most likely to be found in our extensive range of manual, power-operated, and self-acting types, available in standard and special versions for the vast majority of power plant and industrial applications. For a quick survey of the principal lines, write for List 214E.
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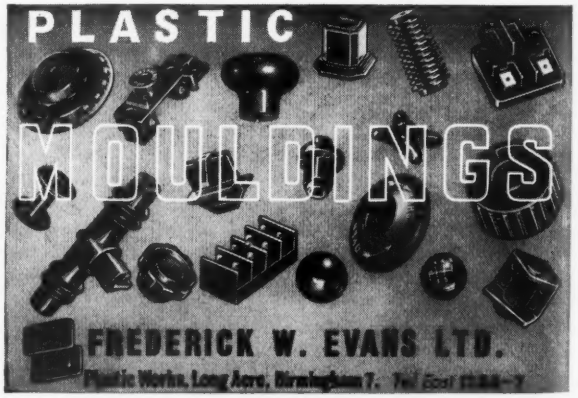

They may LOOK alike . . . BUT!

It'll be a different story once they get behind that door. The maestro on the right will carry the producer away with soulful harmonies . . . but, he on the left will be out on his ear after the first fumbling pizzicato. Papers are like that, you know . . . particularly packing papers! They can be good, bad or indifferent, and only the trained mind can instruct its eye to see the difference. If you don't know what constitutes a good packing paper it may be fatal to make a choice from appearances. It's far safer to look for the name 'Carco,' which tells you so much that you CAN'T see. 'Carco' Protective packing papers have proved themselves under the most gruelling conditions, in transit throughout the world. In the 'Carco' Range there's a packing paper to meet any occasion and counter every threat. Just tell us what you want to pack, and what stringencies it has to face and leave it to us, we know the perfect answer! All our packing papers are laboratory controlled throughout manufacture and fully tested before despatch.

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B Recessed display lighting.
C Surface display lighting.
D Industrial lighting.
E Pendant commercial lighting.
F Recessed troffer window lighting.
G General commercial lighting.
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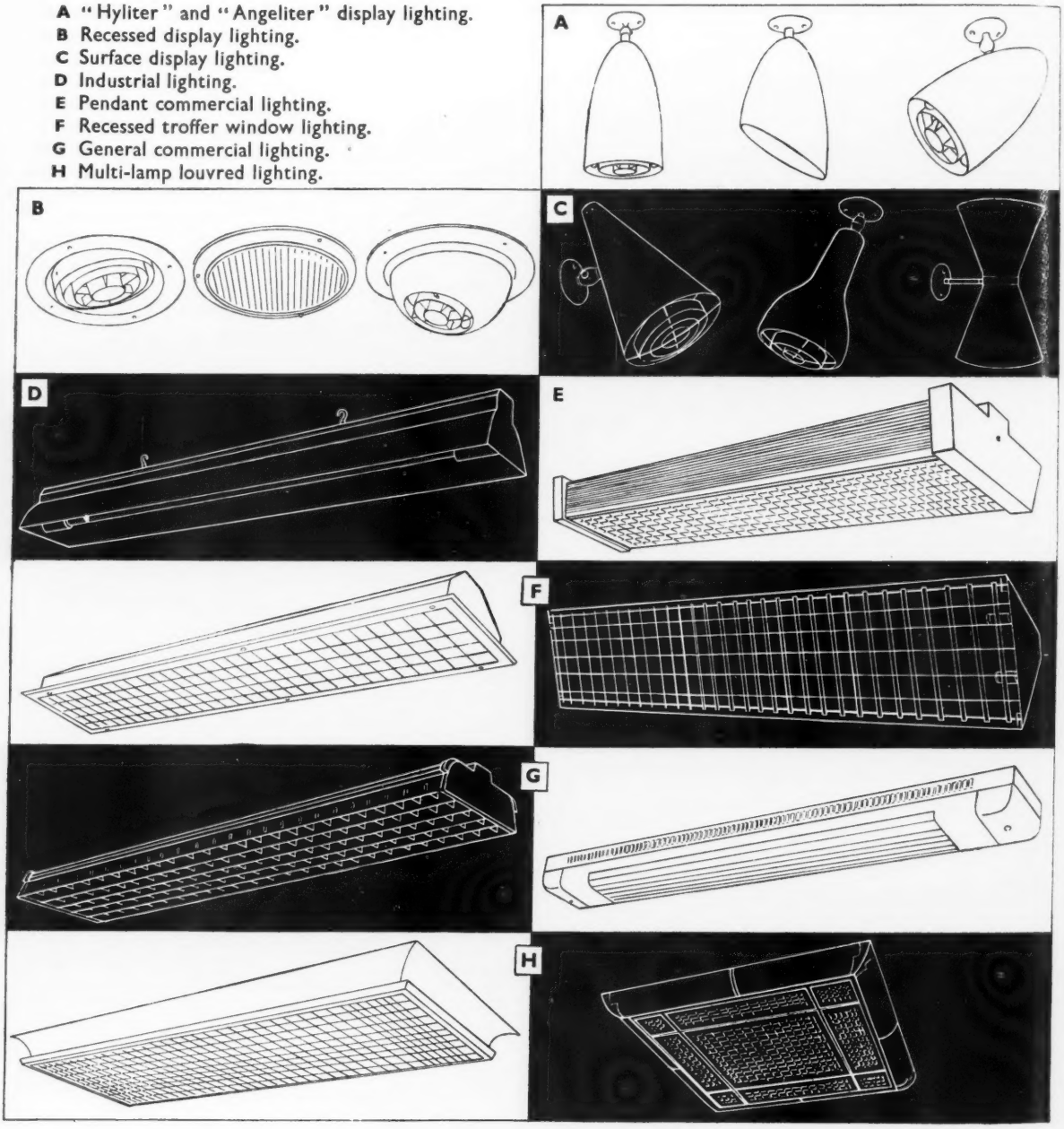

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COURTNEY, POPE (ELECTRICAL) LTD.

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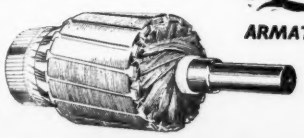
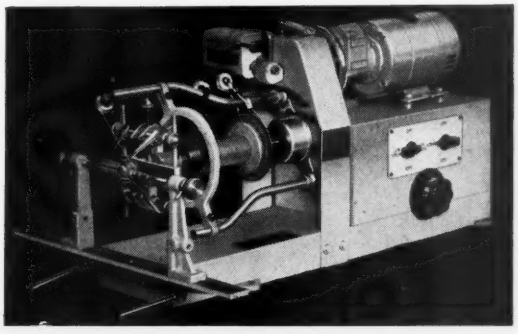
MDC LTD. Quickway

ARMATURE WINDING MACHINES





MODEL 1B

The machine illustrated is the "QUICKWAY" Model 1B designed for the electrical repair trade to wind two pole armatures up to 3" core diameter—2½" core length, and wire sizes between 45 — 24 S.W.G. Special models for production armature winding also available.

Apply to Quickway Dept. for full details.

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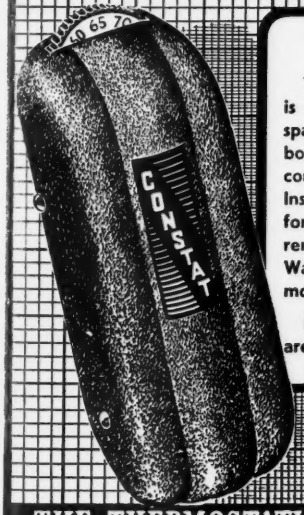

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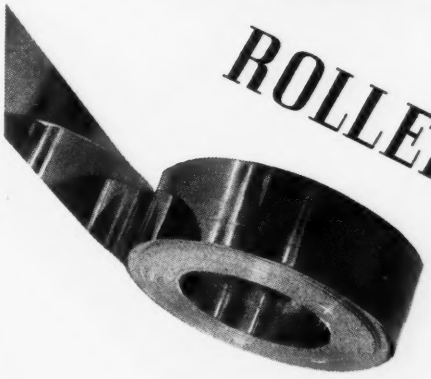

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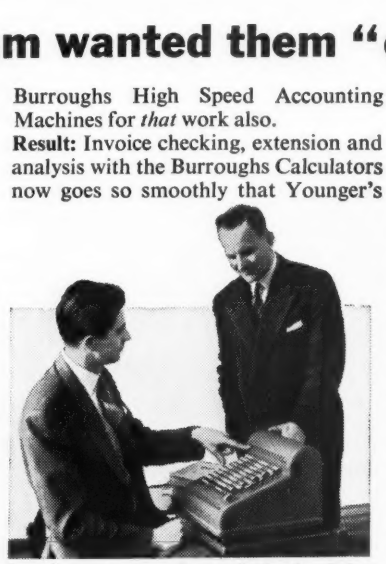

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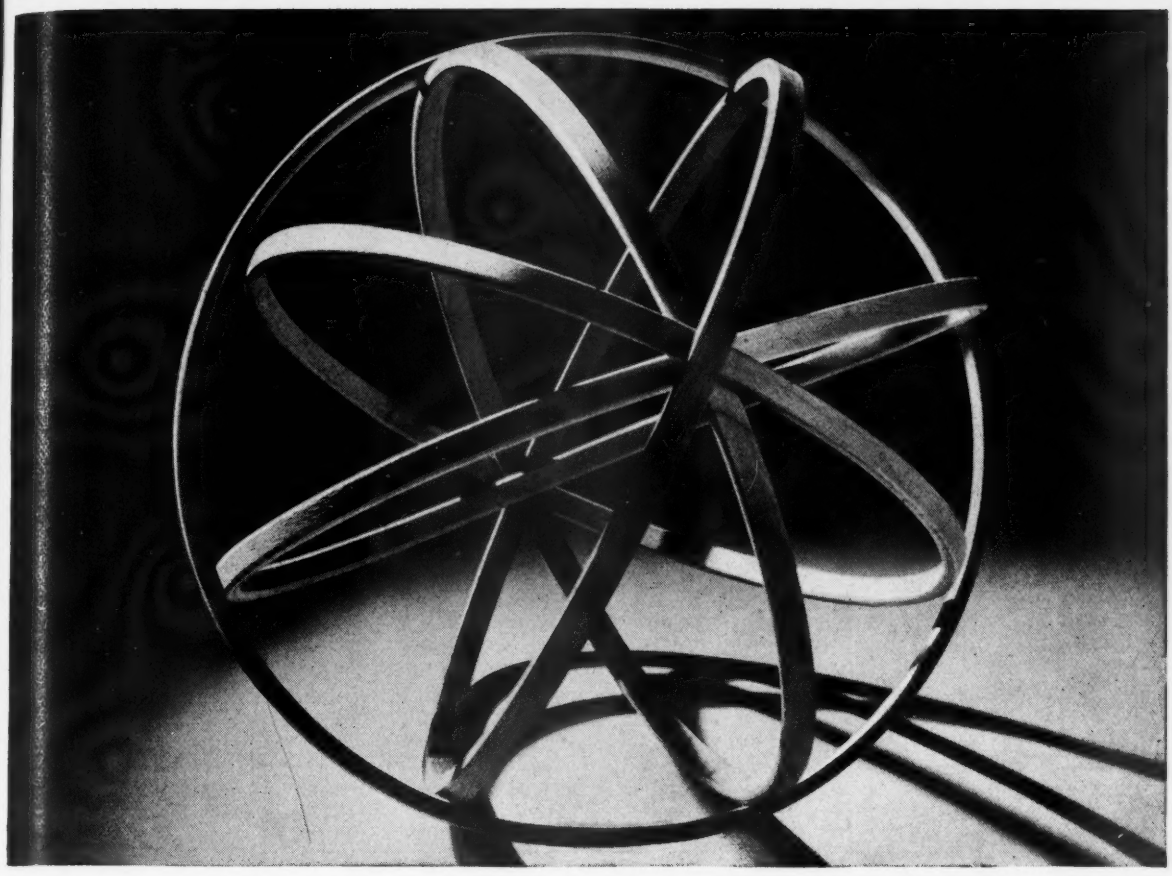

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* *The word armillary has nothing to do with either armadillos or armament. It comes from the Latin* armilla, *meaning bracelet. An armillary sphere was a model made by the Greeks, 2,000 years ago, to depict the great circles of the heavens. But that was a little before our time.*

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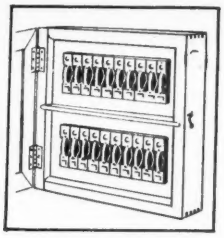

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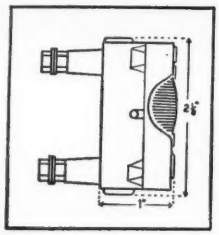

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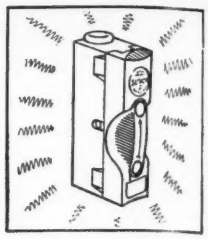

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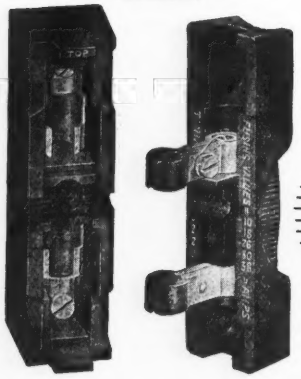

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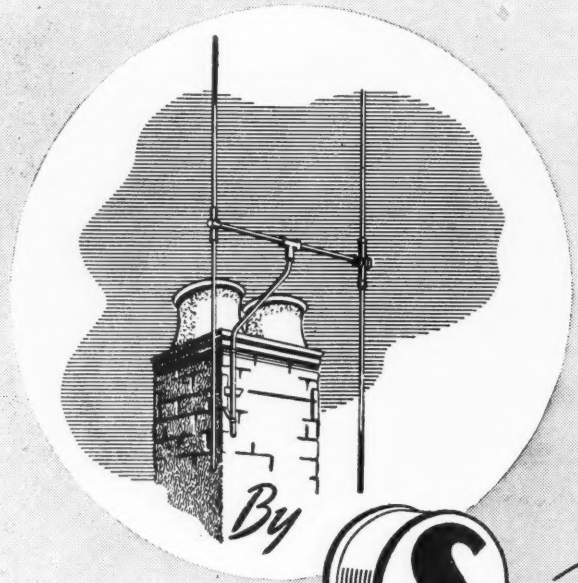

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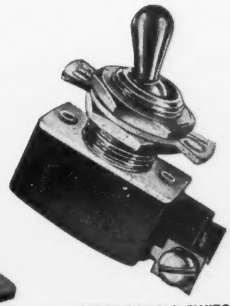

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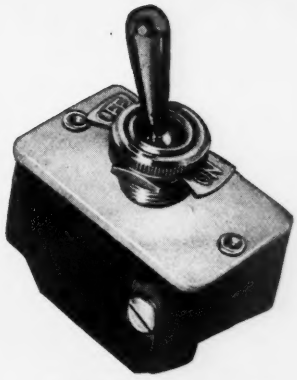

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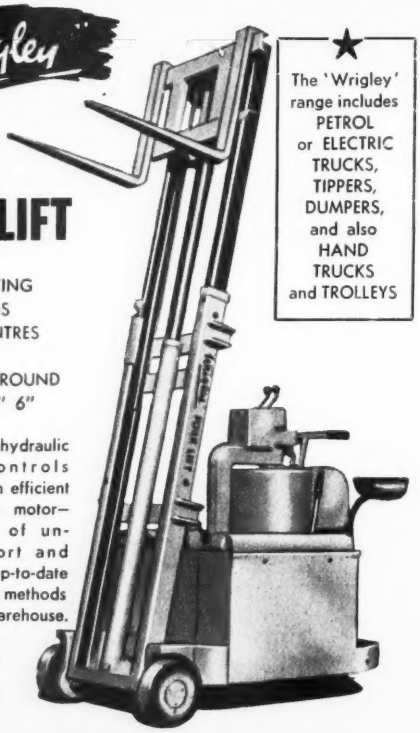

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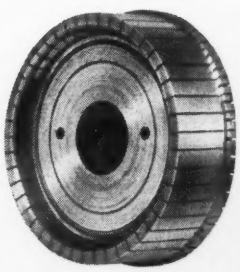

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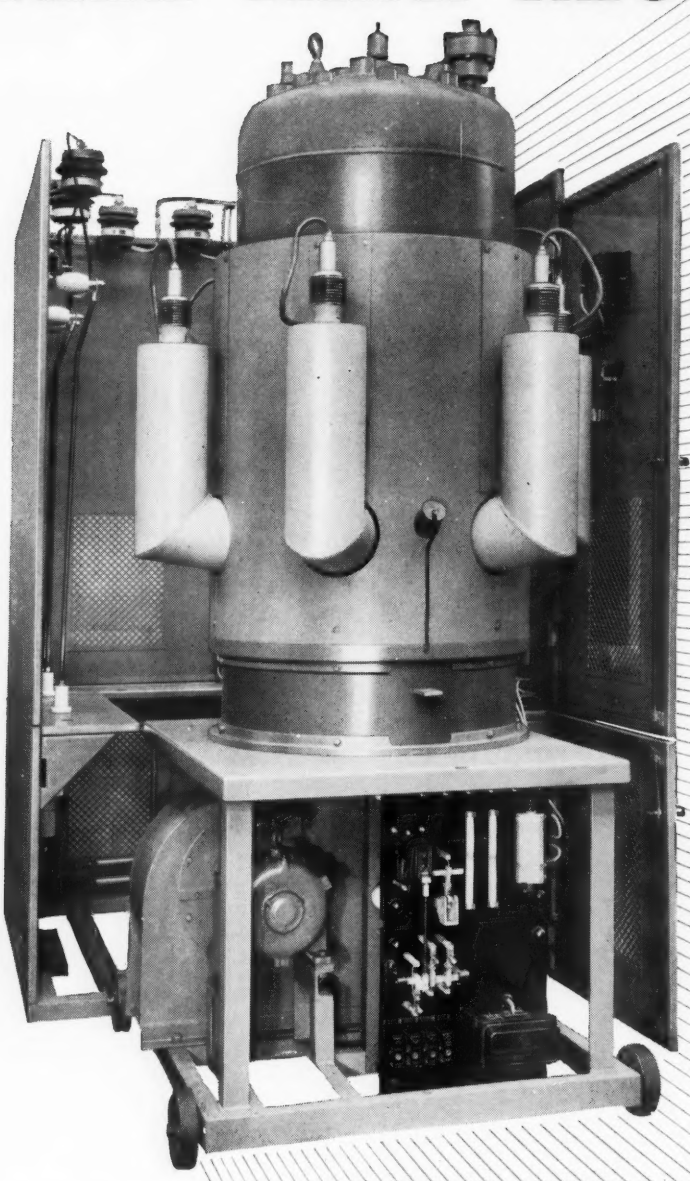

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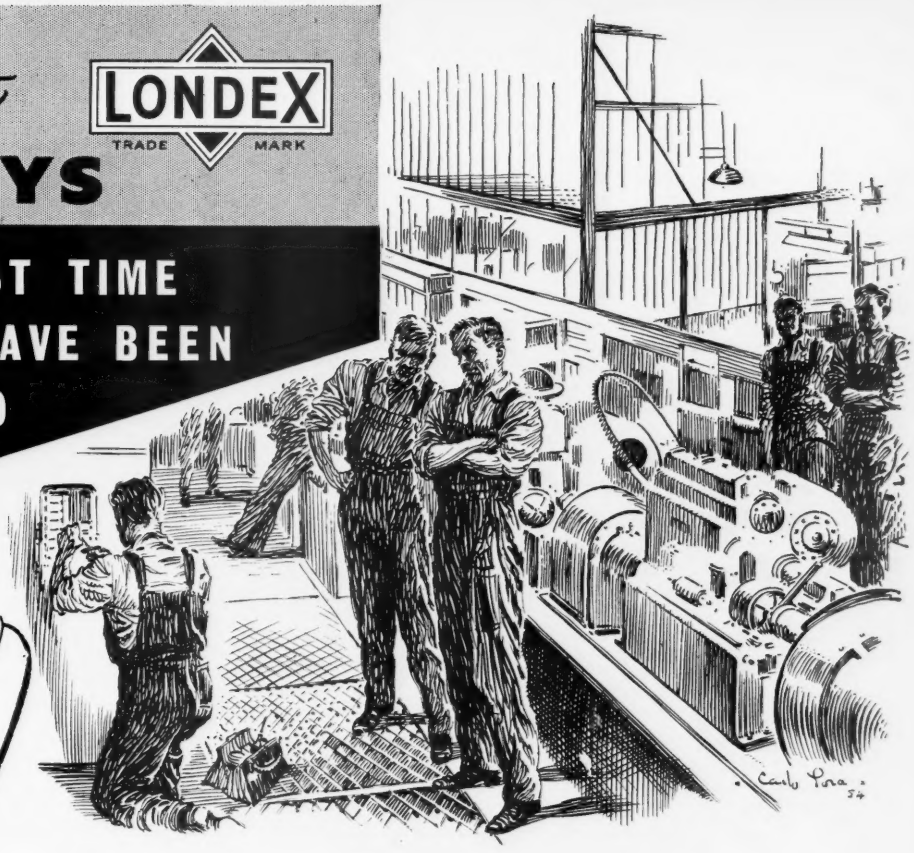

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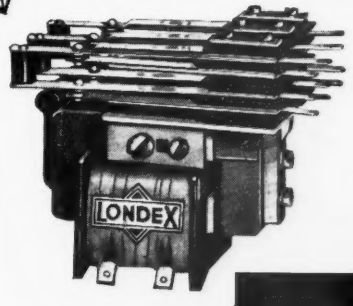

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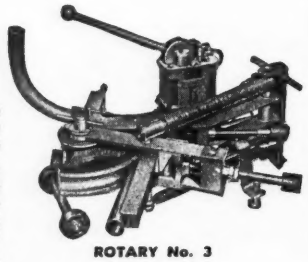

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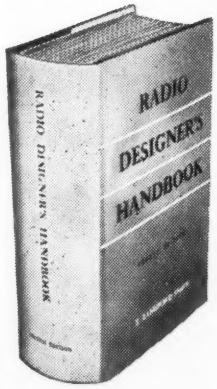

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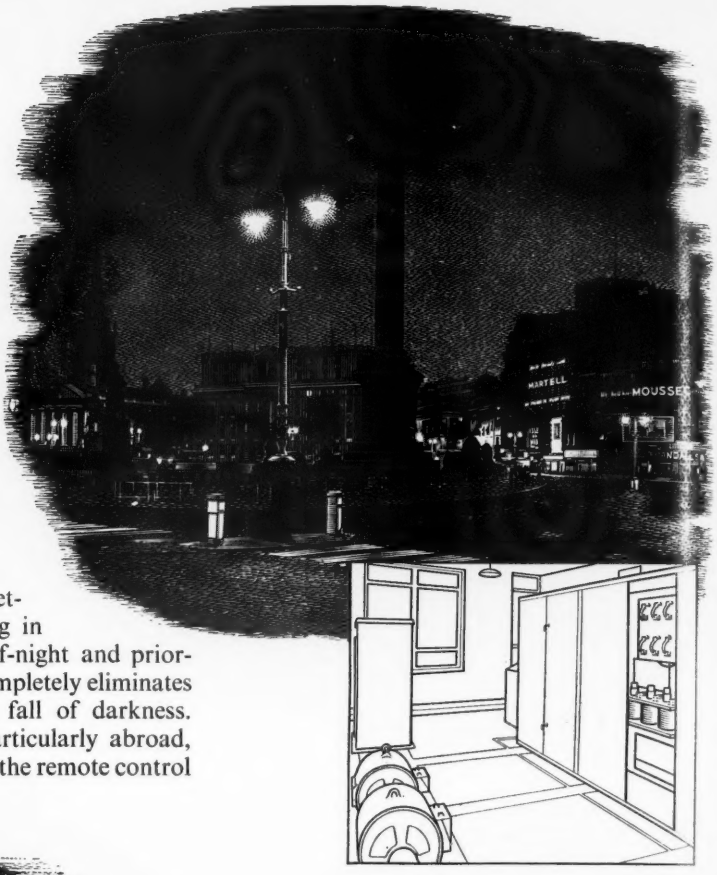

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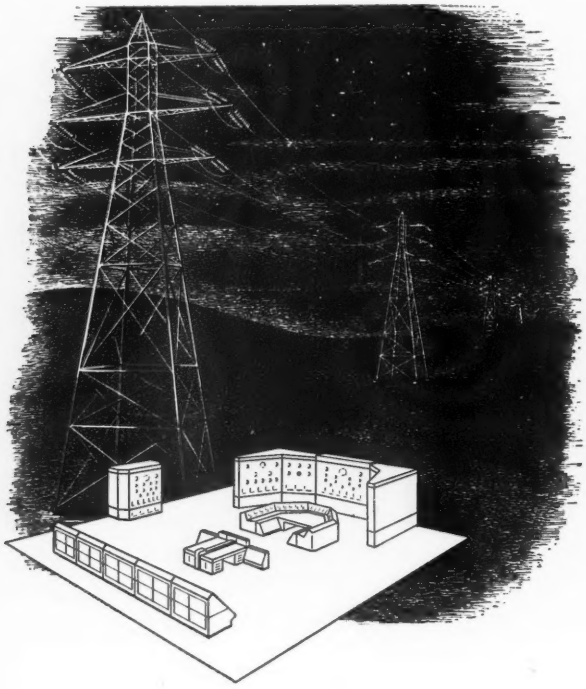

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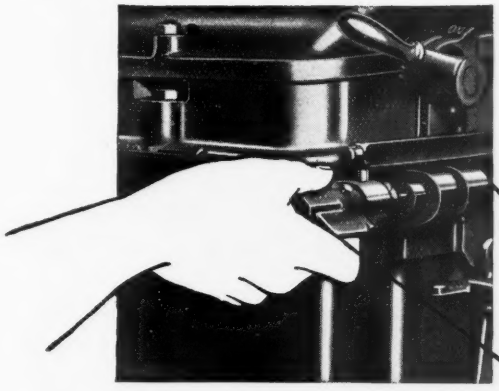

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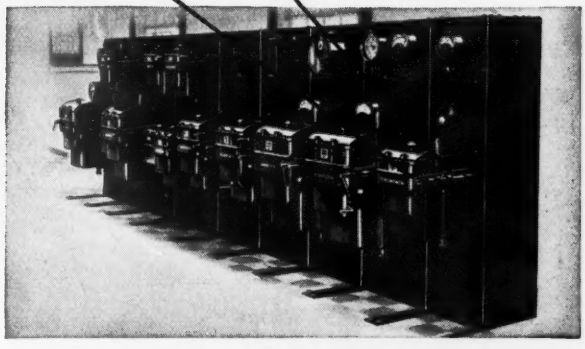

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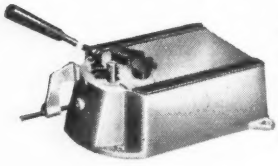

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Strips insulation from cables up to ⅝" outside diameter, no splaying, no nicking; and one single movement does the whole job quickly and cleanly.

The days of clumsy stripping with knife or pliers have gone—the efficient, modern method is to use HYDE wire and cable strippers. Adjustable stops control length of strip. For greater production and perfect results, without skill or experience, HYDE strippers are essential.

Obtainable from all good Tool Dealers or directly from the makers :

J. B. HYDE & CO LTD.
Altrincham Road,
WYTHENSHAWE, MANCHESTER.
Telephone : WYThenshawe 2850.
Telegrams : "Braiding" Wythenshawe.

THE 'ARORA' REFLECTOR FIRE
WITH THE **LONG-LIFE** ELEMENT

THE POPULAR **FOUR-TEN** MODEL
IS NOW AVAILABLE IN 1-BAR
& 2-BAR SIZES

Send for full details to :—

THE ARORA COMPANY
ROSEBERY ST., LOUGHBOROUGH, LEICS
Telephone 2603

---

dependable
ELEMENTS
for every job

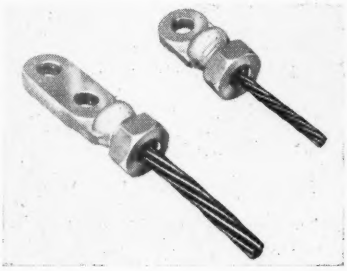
Stocked by Leading Wholesalers

THE
ELECTRIC ELEMENTS CO.
Tokenhouse Yard, Nottingham
Makers of Elements since 1921

USE
MONMER
GREY IRON CASTINGS

for speedy and
economical production

Send us your enquiries
MONMER FOUNDRY LTD.
ST. ANNES ROAD, WILLENHALL, STAFFS
Telephone : Willenhall 62



CONE GRIP
CONNECTORS
for $\frac{3}{16}$" — $\frac{3}{4}$" cable

All types of solderless electrical connectors from ¼" — 3"

BRITISH SWITCHGEAR CORPORATION Ltd.
MAKERS OF H.T. SWITCHGEAR
Morden Factory Estate, London, S.W.19
Lib. 2273-5

Copper Strip

A VIEW OF THE HIGH SPEED MACHINES FOR DRAWING AND ROLLING COPPER STRIPS IN THE UP-TO-DATE WORKS OF R. H. SYMONDS LTD.

EVERY process in the manufacture of Symonds' H.C. Copper Wire and Strip is carried out with a care and skill which has earned them their fine name among Cable Manufacturers and other users of their materials.

R. H. SYMONDS LTD

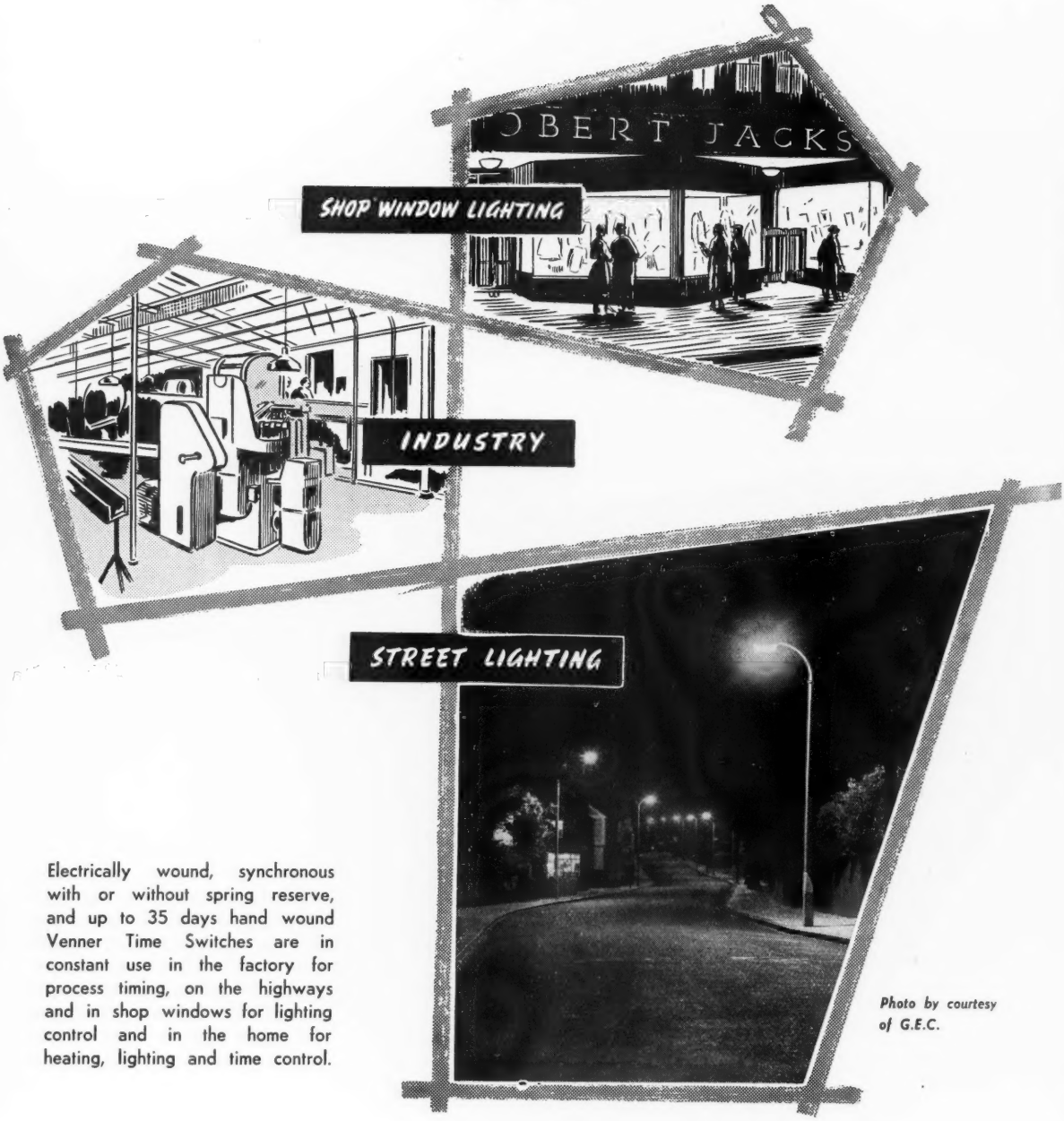
Manufacturers of: H. C. Copper Wire. Soft and Hard drawn. Plain and Tinned.
H. C. Copper Strip. Soft Plain and Hard drawn.

47, VICTORIA STREET, LONDON, S.W.1. *Tel: ABBey 2771/5*

THE FIRM WITH THE RIGHT CONNECTIONS

Agents for: W. B. STOCKER & CO. LTD. Rubber Suppliers to the Cable Trade.
F. C. ANNETT & CO. LTD. Carbide Pellets and Dies.

Automatic

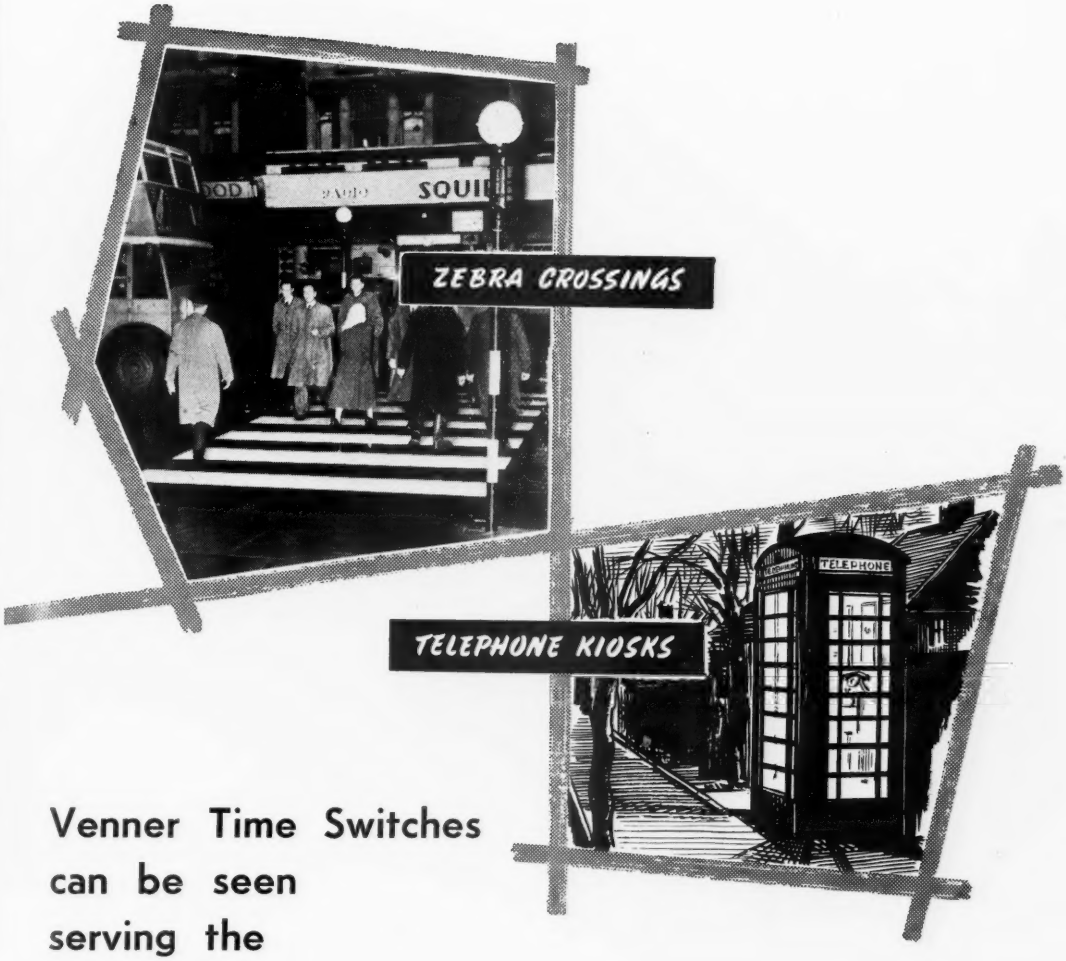


Electrically wound, synchronous with or without spring reserve, and up to 35 days hand wound Venner Time Switches are in constant use in the factory for process timing, on the highways and in shop windows for lighting control and in the home for heating, lighting and time control.

Photo by courtesy of G.E.C.

VENNER LIMITED

TIME CONTROL



Venner Time Switches can be seen serving the community in many widely contrasted applications

You may have a time control problem which Venner can solve. Why not get in touch with our Sales Dept. ?

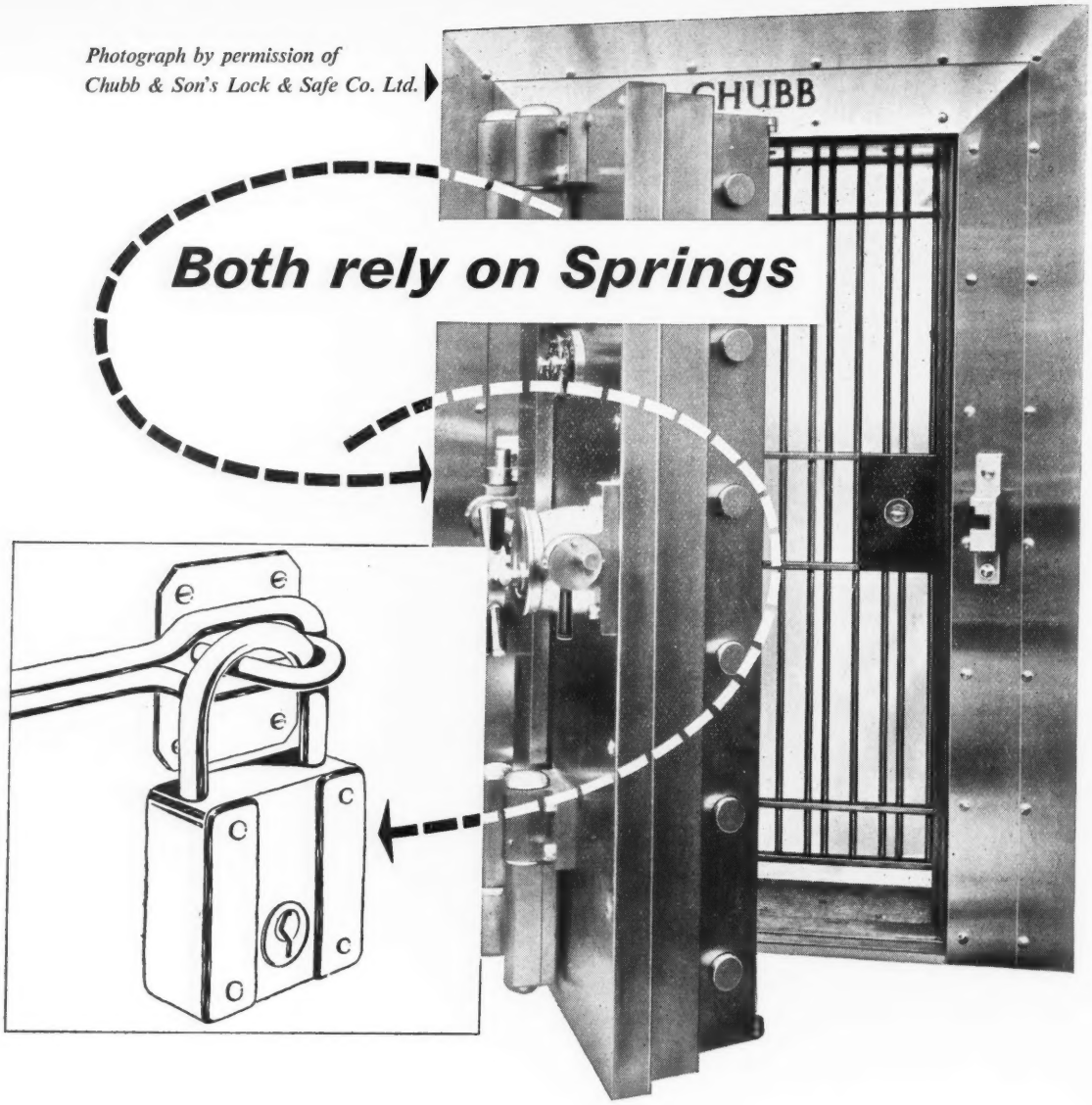
VENNER

TIME SWITCHES

KINGSTON BY-PASS • NEW MALDEN • SURREY. Telephone : MALden 2442 (7 lines)

Associated Companies : VENNER ACCUMULATORS LTD. • VENNER ELECTRONICS LTD.

Photograph by permission of Chubb & Son's Lock & Safe Co. Ltd.



Both rely on Springs

reliable Springs by

From the high precision spring required for a strongroom door to its simpler counterpart in a padlock, the right spring for the job is essential to ensure perfect performance. When your springs are designed and made by Salter, they are just right — not the cheapest obtainable but fit to work for ever.

SALTER

Service to Engineers since 1760

A tradition of quality in craftsmanship and materials is embodied in every Salter spring — you can depend on Salter for the *right spring for the job.*

Geo. Salter & Co. Ltd., West Bromwich

TOK takes the lead with this PACKET TYPE SWITCH . . .

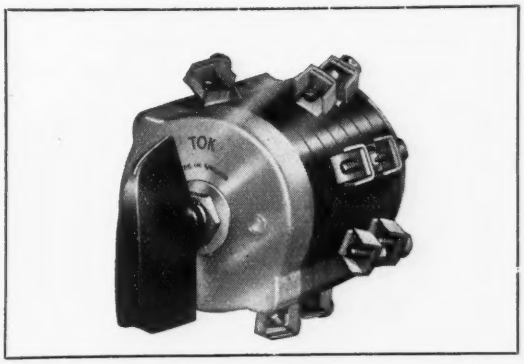
13/25 AMP rating for AC/DC and AC only

Here is a rotary switch that is very robust yet unusually compact. Clever design of the die cast top and indexing mechanism, with improved methods of fixing achieve considerable saving in height.

Contacts and terminals are of ample dimensions for the specified rating. Moulded packets are of high grade electrical quality bakelite. All other materials meet the most stringent electrical and mechanical requirements of the BSI.

Easy installation. Standard circuits are available including single, double and triple pole ON OFF selective switching and motor reversing; but switches are also made up to customers' own circuit requirements.

Ask for pamphlet No. 17.



Address your enquiries to :

TOK | **TOK ELECTRICAL & INDUSTRIAL MECHANISMS LTD.**

264-270 ST. JOHN STREET, CLERKENWELL, E.C.1. *Telephone: Clerkenwell* 2917

Now ready

A new technical book for television, radio and electronics engineers . . .

THE OSCILLOSCOPE AT WORK

By A. Haas and R. W. Hallows, M.A.(CANTAB), M.I.E.E.

'The Oscilloscope at Work' is an invaluable guide to the instrument's many uses—not only in radio, and TV, but also in electronics generally. An important feature is the book's wealth of oscillograms—well over 200 being included. Numerous circuit drawings and other diagrams clarify the text. Although 'The Oscilloscope at Work' deals mainly with the uses of the instrument, and interpretation of its oscillograms, it also contains much practical information on oscilloscope circuits, construction, adjustment and fault-finding. Advanced students will also find this book invaluable.

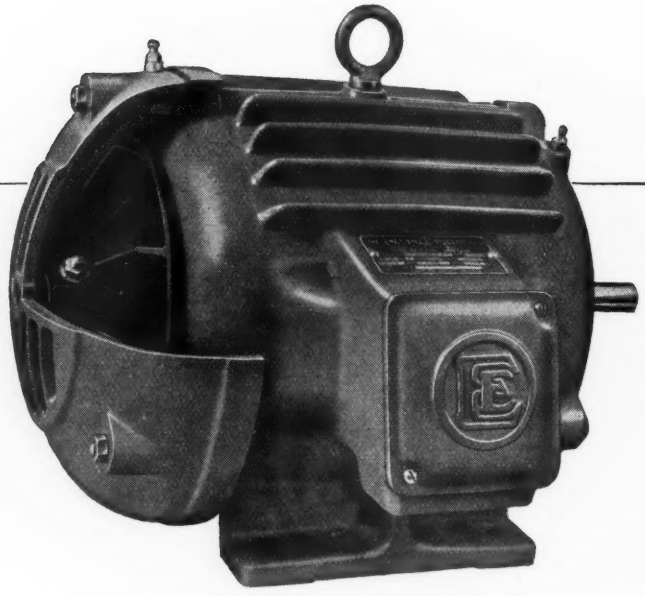
Size 8¾″ x 5½″. 172 p.p. **15s. net.** By Post 15s. 6d.

Published for "Wireless World"

From booksellers or direct from Iliffe & Sons Limited, Dorset House, Stamford Street, London, S.E.1

B.S.D.
BRITISH STANDARD DIMENSIONED

Chemical Works Motors
Class 'LYC'



Class 'LYC' totally-enclosed fan-cooled squirrel-cage motors which conform to specification BS.2083 are now available for use in corrosive atmospheres.

In the illustration, the cowl of the motor has been cut away to show the moulded plastic fan. The plastic rating plate can also be seen.

Special features of the chemical works motor which give long " corrosive life "

- Stator, endshield, fan cowl and terminal box are of rugged cast-iron construction.
- Anti-corrosive winding treatment.
- Moulded plastic fan.
- Plastic rating plate.

'ENGLISH ELECTRIC'
industrial motors

See also our Fusegear advertisement in this issue

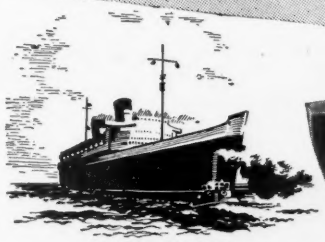
THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Industrial Motor Works, Bradford

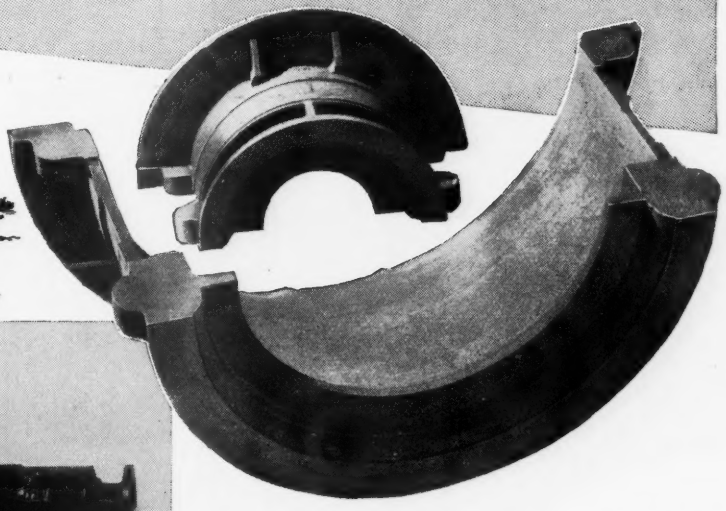
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

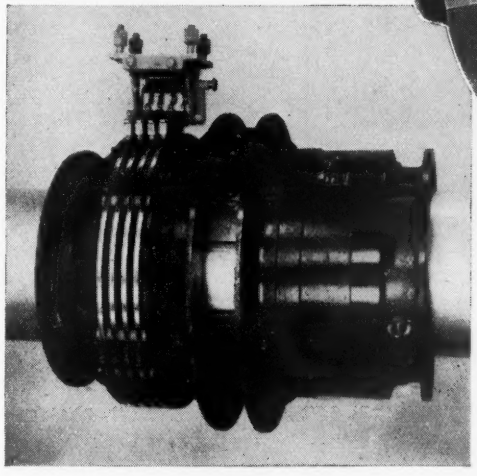
BM.26

SIEMENS BROTHERS specify HARPER CASTINGS for extreme accuracy & dimensional stability



AS USED ON R.M.S
QUEEN ELIZABETH & QUEEN MARY





For the sleeve castings of their well-known 'Siemens-Ford' Electrical Torsionmeter, Siemens Brothers & Co. Limited use Harper Castings. The angle of torsion of the shaft which is transmitting power affects a transformer device between adjacent flanges, the value measured being in the region of 0.025 in. with a required accuracy of $\pm \frac{1}{2}\%$.

Siemens Brothers say: "Castings of high tensile strength, with uniformity of structure and constant thickness, and free from distortion and 'creep' are necessary"

HARPER CASTINGS

Harper quality covers iron castings, and also metal pressings, machining, enamelling and other finishes and sub-assembly work.

CASTINGS WITH THE HARPER SKIN

JOHN HARPER & CO. LTD. JOHN HARPER (MEEHANITE) LTD.
ALBION WORKS Phone: WILLENHALL 124 (5 lines) Grams: HARPERS, WILLENHALL **WILLENHALL**

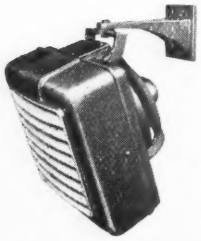
LONDON OFFICE: SEAFORTH PLACE, 57, BUCKINGHAM GATE, LONDON S.W.1 Tel.: TATE GALLERY 0286
MANCHESTER OFFICE: c/o B. J. Brown & Partners Ltd., 248/9 Royal Exchange, Manchester 2

H 383

Thermalair

HEATING and VENTILATING EQUIPMENTS

3-5 kW FAN UNIT HEATER



- All types of space heating equipment supplied
- Safety Switch
- Summer Ventilation
- Accessible for service
- Economical and easy to instal

3 kW Fan Unit Heater £12.12.0 list
5 kW Fan Unit Heater £15.15.0 list

Specification—

Casing : Aluminium Alloy of high tensile strength.
Elements : High-grade Nickel Chrome. Black Heat, easily replaceable.
Motor : Shaded Pole Single Phase with large bearing surface.
Voltages : 3 kW, 200/250 V, A.C.
5 kW, 346/440 V, A.C.
Finish : Polychromatic Bronze.

H.V.E. (ELECTRIC) LTD.

3 Rodley Lane, Rodley, Leeds, Yorks

Phone: Pudsey 2830

Amalgam RESINACT—

A supremely efficient new solder

FREE testing sample. Write to us for a sample of this new A.I.D. approved, activated solder wire with non-corrosive RESINACT core. It is specially designed for all electrical work and is available to any specification in sizes from 4-22 W.G. We are specialists in all forms of fusible alloys.

GREY & MARTEN LTD

ESTABLISHED 1833

CITY LEAD WORKS · SOUTHWARK BRIDGE · S.E.

Telephone: HOP 0414 Telegrams: Amalgam, Sedist, London

and at Birmingham and Ipswich

PERFORATIONS

IN ALL METALS AND MATERIALS FOR ALL TRADES INCLUDING ELECTRICAL, HEATING, VENTILATING, ETC.

W. BARNS & SON (HOLLOWAY) LTD.

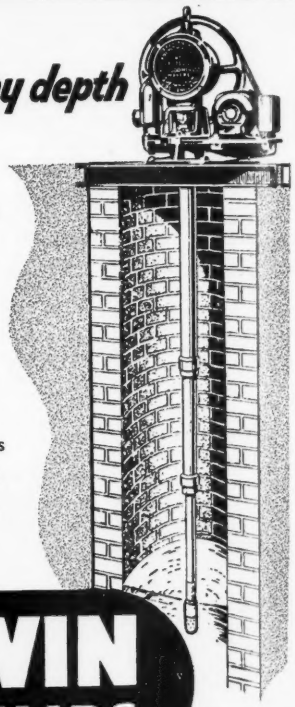
Successors to W. BARNS & SON - Established 1860

GLOBE WORKS, QUEENSLAND ROAD, HOLLOWAY, LONDON N.7

Telephone: NORTH 3347-8

Telegrams: PERFORATION HOLWAY LONDON

For wells of any depth



TYPE E.O.E. for Wells and Boreholes exceeding 25 ft. in depth. Totally enclosed self-oiling mechanism of Patented design. Precision workmanship throughout. Pump can be supplied complete with 1/3 h.p. Electric Motor or with fast and loose pulleys for belt drive. Capacities from 58 gallons per hour.

GODWIN *Electric* **PUMPS**

Telephone: Coln St. Aldwyns 271 (5 lines)
Grams: "Pumps Quenington"

H. J. GODWIN LTD. · QUENINGTON · GLOS

Biddle

·75″ PITCH CHAIN DRIVES

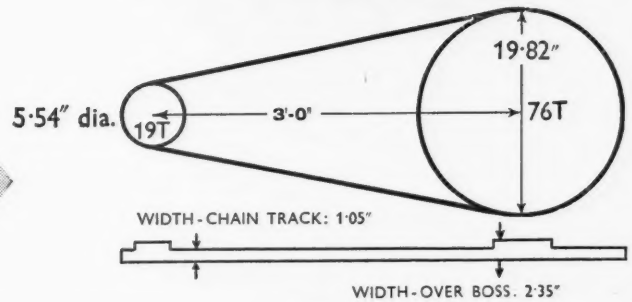
Example of low cost ★

17½ H.P. DRIVE

at 1,450 r.p.m.

ratio 4 : 1

SAVE SPACE and COST LESS PER H.P.



SELECTION OF DRIVES FROM THE ·75″ PITCH SIMPLE STANDARD STOCK SERIES RANGE

Ratio	Pinion	Wheel	LIST PRICES for 3'-0" centres £	s	d
1 : 1	25T	25T	6	0	0
2 : 1	19T	38T	6	4	0
3 : 1	19T	57T	6	18	0
4 : 1	19T	76T	8	2	0 ★
5 : 1	19T	95T	9	6	0
6 : 1	19T	114T	10	10	0

RENOLD

STANDARD STOCK SERIES **CHAIN DRIVES UP TO 140 H.P.**

WRITE FOR CATALOGUE REF. 116/78/10D-2

RCCC **THE RENOLD & COVENTRY CHAIN CO LTD • MANCHESTER**

Transmission and Conveying Chains, Wheels and Accessories for all mechanical purposes

for–

SUPERB

QUALITY–
EFFICIENCY–
RELIABILITY–
and STAMINA–

Ask by NAME

for

Osram

TUBES

FOR FLUORESCENT LIGHTING

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are **PREPAID** at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.

DISPLAYED:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND) 1954

CITY AND COUNTY BOROUGH OF BELFAST

Electricity Department

TENDERS are invited for the supply, delivery and erection at the first extension of Belfast Municipal Electric Power Station West of:

Four 630,000 lb. per hour motor-driven Boiler Feed Pumps and one 650,000 lb. per hour steam turbine-driven Boiler Feed Pump, the pump discharge pressure being approximately 1,220 lb. per square inch.

Form of tender (N.1274), conditions, specification and drawings, in quintuplicate, may be obtained from Messrs. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle upon Tyne, 1, on payment of a deposit of five guineas, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the contract document may be obtained at one guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Boiler Feed Pumps, Electricity Department," and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 19th August, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON,
Chairman,
Northern Ireland Joint Electricity Committee.

Chichester House,
Chichester Street, Belfast.
25th June, 1954. 3902

MIDLOTHIAN COUNTY COUNCIL

TENDERS are invited for (a) the supply and erection of 13, 25 ft. Reinforced Concrete Street Lighting Columns and (b) the supply and installation of 13, 140-watt Sodium lamps, lanterns and fittings, to be erected on Trunk Road Route A.7 (Carlisle Road) in Newton Grange.

Specifications, bills of quantities and forms of tender may be obtained from, and the site plan seen at the office of the County Surveyor, 32, Palmerston Place, Edinburgh, 12.

Sealed offers marked "Street Lighting, Newton Grange, Trunk Road Route A.7" should be lodged with the undersigned before 10 a.m. on Monday, 19th July, 1954.

The two tenders are entirely separate and the County Council reserve the right to accept one or both as they may decide.

The County Council do not bind themselves to accept the lowest or any offer.

JAMES McBOYLE,
County Clerk.

County Buildings,
George IV Bridge,
Edinburgh, 1. 3898

CLASSIFIED ADVERTISEMENTS ARE PREPAID

CARDIFF CORPORATION TRANSPORT DEPARTMENT

Underground Cables

TENDERS are invited for the supply and delivery of Underground Cables required for a trolleybus extension scheme.

Specification and forms of tender may be obtained from the Transport General Manager, Central Offices, Wood Street, Cardiff.

Tenders in plain sealed envelopes endorsed "Underground Cables, Ely Trolleybus Extension," but not bearing any name or mark indicating the sender, should reach the undersigned not later than first post on Thursday, 8th July, 1954.

The Corporation reserve the right to accept the whole or any part of any tender.

S. TAPPER-JONES,
Town Clerk.

City Hall, Cardiff.
21st June, 1954. 3875

WILTS COUNTY COUNCIL

TENDERS are invited for the Installation of the Electrical System at the New Grammar School at Wessington, Calne.

Applications, accompanied by a deposit of £2 2s. (cheques only, payable to the Wilts County Council), should be made by Tuesday, 13th July, 1954, on or about which date drawings and specification will be forwarded to applicants.

Tenders to be delivered to this office not later than the first post on Thursday, 5th August, 1954.

No pledge is given to accept the lowest or any tender.

F. I. BOWDEN, A.R.I.B.A.,
County Architect.

County Hall,
Trowbridge.
21st June, 1954. 3838

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE

Principal: H. Baker, Ph.D., A.M.I.C.E., A.M.I.Mech.E.

APPLICATIONS are invited for the post of ASSISTANT LECTURER, GRADE B, IN ELECTRICAL ENGINEERING. It will be an advantage if the person appointed can teach to Final City and Guilds Standard in Regulations and Installations Technology, but a candidate with wide industrial experience and ability to teach Electrotechnology and other electrical subjects to Ordinary or Higher National Certificate standard would be acceptable. Opportunity will be given to undertake some teaching of advanced character if desired.

Salary scale at present £490 × £25 to £765 per annum, with a further £60 for graduate or equivalent qualification and up to 3 increments of £18 each for approved periods of training. Regard may be paid to approved industrial experience when assessing the commencing salary.

Application forms, together with further particulars, may be obtained from the Registrar, Nottingham and District Technical College, Shakespeare Street, Nottingham, to whom they should be returned not later than 14th July, 1954.

F. STEPHENSON,
Clerk to the Joint Education Committee.

23rd June, 1954. 3881

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited from suitably qualified engineers for the following positions:—

ASSISTANT ENGINEER (Instruments), Freemen's Meadow Power Station, Leicester (Vacancy No. 93/54/ER). Applicants should have the Higher National Certificate or equivalent together with sound practical experience in the maintenance of instruments in a P.F. fired generating station.

Salary for this appointment will be within Class H, Grade 10 (£641-£667 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 12th July, 1954.

OPERATION AND EFFICIENCY ENGINEER, Drakelow Power Station, Nr. Burton-on-Trent (Vacancy No. 95/54/ER). Candidates should have wide experience of the operation and maintenance of a large generating station with P.F. boiler plant. The successful applicant will be responsible to the Station Superintendent for ensuring that all sections of the plant attain the specified efficiency and for the carrying out of special investigations and tests.

Corporate Membership of the Institution of Mechanical Engineers and/or Institution of Electrical Engineers is desirable.

Salary for this appointment will be within Class J, Grade 6 (£883-£918 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 19th July, 1954.

ASSISTANT SHIFT CHARGE ENGINEER, Spondon Power Station (Vacancy No. 96/54/ER). Applicants should possess the Higher National Certificate or its equivalent and have had experience in a responsible position in a modern generating station.

The salary will be in accordance with Class H, Grade 9 (£680-£706 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 19th July, 1954.

These appointments will be pensionable within the terms and conditions of the British Electricity Authority and Area Boards Superanuation Scheme.

Applications should be submitted on the official form AE6/ACT wich may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller. 3905

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above position in the Design and Planning Branch of the Northern Sub-Area.

Applicants should preferably have had experience on mains recording with a public utility authority, preferably with an Electricity Board, and be able to obtain particulars on site and compile accurate permanent records. Some knowledge of electrical plant layout, building construction and simple reinforced concrete structures would be an additional advantage.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £458 to £595 7s. per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 10 days of the publication of this advertisement. Please enclose addressed envelope and quote ref. V/1764/R on all correspondence. 3839

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Lanarkshire Sub-Area

(1) Appointment of Second Assistant District Engineer, Uddingston District
(2) Appointment of Third Assistant District Engineer, Motherwell District
(3) Appointment of General Assistant Engineer, Sub-Area Planning and Development Department

APPLICATIONS are invited for the above appointments. Applicants should preferably be Graduates of the Institution of Electrical Engineers or hold equivalent qualifications.

The salary and conditions of service for each appointment will be in accordance with the National Joint Board Agreement, Schedule A. The present classification and grading for each appointment will be as stated below.

The successful candidates for appointments Nos. 1 and 2 will require to reside within a reasonable distance of the respective District Offices, and for appointment No. 3 within a reasonable distance of the Sub-Area Offices at Hamilton.

(1) Appointment of SECOND ASSISTANT DISTRICT ENGINEER, UDDINGSTON DISTRICT. Applicants for this appointment should have had a sound engineering training with subsequent experience in the operation and maintenance of H.V. and L.V. switchgear, overhead and underground distribution systems, commissioning and routine testing of feeder protection equipment, together with some experience of H.V. fault location.

The present classification and grading for this appointment is F.7, salary £697/£718 per annum, which will be subject to the statutory deductions, including superannuation.

(2) Appointment of THIRD ASSISTANT DISTRICT ENGINEER, MOTHERWELL DISTRICT. Applicants for this appointment should have had a sound engineering training with subsequent experience in the operation and maintenance of H.V. and L.V. switchgear and overhead and underground distribution systems.

The present classification and grading for this appointment is F.9, salary £607/£629 per annum, which will be subject to the statutory deductions, including superannuation.

(3) Appointment of GENERAL ASSISTANT ENGINEER, SUB-AREA PLANNING AND DEVELOPMENT DEPT. Applicants for this appointment should have had a sound engineering training and a knowledge of short circuit calculations, load flow diagrams and voltage drop calculations, together with some experience in the design and layout of H.V. and L.V. underground and overhead distribution systems.

The present classification and grading for this appointment is K.13, salary £583/£605 per annum, which will be subject to the statutory deductions, including superannuation.

Application forms for the above appointments, which may be obtained from the undersigned or any other Sub-Area Manager, should be returned to this office within 14 days of the date of this notice.

DUGALD SMITH,
Manager.

137, Almada Street,
Hamilton.
21st June, 1954. 3853

BRITISH ELECTRICITY AUTHORITY

Midlands Division

ARCHITECTURAL DRAUGHTSMEN are required in the civil engineering section of the Construction Department at Wolverhampton. N. J. B service conditions, superannuable appointments, salaries within Schedule D. Grade 5 of the Agreement, £567 to £671 per annum.

Applicants should have had a sound technical education and practical experience in the layout and design of large buildings, canteens, office blocks, and similar constructions, preferably associated with generating stations. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 697MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 17th July, 1954. 3907

YORKSHIRE ELECTRICITY BOARD

Head Office

SECOND ASSISTANT ENGINEER, DISTRIBUTION DESIGN (SUBSTATIONS) SECTION. Duties will include the design of indoor and outdoor primary substations operating at voltages of 33 kV and above, the selection of protective gear installations for the primary H.V. systems, the preparation of specifications and enquiries for substation plant, negotiations with manufacturers and inspection of equipment in course of manufacture.

Applicants should be Corporate Members of the Institution of Electrical Engineers and should preferably possess a University degree in electrical engineering. They should have a sound knowledge of substation requirements and have had experience of large H.V. substation construction. Specialist knowledge of H.V. switchgear or of protective gear would be an advantage.

Salary N.J.B. Schedule C, Class AX-EX, Grade 2, £834/£1,083 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Leeds, not later than 15th July, 1954.

No. 5 (Wakefield) Sub-Area

CASTLEFORD DISTRICT

GENERAL ASSISTANT DISTRICT ENGINEER. Applicants must have had a sound practical training with experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants must hold a current driving licence, be prepared to reside in the district and undertake standby duties.

Applicants must have at least a Higher National Certificate in Electrical Engineering or equivalent qualifications.

Salary N.J.B. Class F, Grade 11, £548/£565 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 15th July, 1954 3899

SOUTH EASTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT ENGINEER, Weald District. Salary N.J.B. Class D, Grade 5, £714-£731 p.a. Superannuable. Applicants, preferably Corporate Members of the I.E.E., should have had considerable experience in electricity distribution work covering the planning, construction, operation and maintenance of systems up to 33 kV.

Applications on forms from W. J. Collins, A.M.I.E.E., Weald Manager, SEEBoard, Highgate, Hawkhurst, Kent, to be returned by 14th July, 1954.

SENIOR SALES REPRESENTATIVE (Male), Sutton District. Salary £485 × £20 to £545 p.a. plus London weighting under N.J.C. Grade 2. Superannuable. The person appointed will be required to give advice on supply matters, tariffs, and appliance sales and installation for domestic and small commercial consumers. Applicants must be thoroughly conversant with all types of domestic electrical appliances and in addition to acting as an outside representative must be prepared to carry out general showroom duties in any showroom within the Sutton District.

Applications on forms from C. W. Emanuel, M.I.E.E., Sutton Manager, SEEBoard, 52, High Street, Sutton, Surrey, to be returned naming 2 referees by 14th July, 1954.

DEMONSTRATOR / SHOWROOM ASSISTANT (Female), Woking District. Salary £400 × £20 to £480 × £10 to £490 p.a. N.J.C. Grade 1. Superannuable. Applicants should have showroom experience and be capable of demonstrating electrical appliances both in showrooms and on consumers' premises and be in possession of an E.A.W. certificate.

Applications, naming 2 referees, on forms from J. C. Poole, A.M.I.E.E., Woking Manager, SEEBoard, 4, Chobham Road, Woking, to be returned by 14th July, 1954.

A. L. BURNELL.
Secretary. 3903

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London allowance.

GENERAL ASSISTANT ENGINEER, Thames Grid Control Area London (Vacancy No. 54/370). Technical education to Higher National Certificate and power station experience an advantage. Successful candidate must be prepared to work shift hours if required. Salary in scale Class AX, Grade 8 = £526 5s. to £670 19s. rising to ultimate maximum EX.8 £749 14s. per annum.

FIRST ASSISTANT STATION CHEMIST, Barking "C" Generating Station (Vacancy No. 54/499). Candidates should possess experience in the analysis of fuels, oils, waters and materials of construction used in power generating and be competent to carry out ad hoc investigational work of an analytical character. Minimum qualification of Higher National Certificate is required in addition to experience. Salary Class J, Grade 9 = £754 19s. per annum.

JUNIOR ENGINEER, West Ham Generating Station (Vacancy No. 54/500). General and control duties (shift). Good technical education with power station experience an advantage. Salary Class H, Grade 14 = £541 16s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, Generation House, Great Portland Street, W.1, and be received within 14 days of this advertisement. 3900

HER MAJESTY'S COLONIAL SERVICE

Engineers, Posts and Telegraphs Department, Nigeria

DUTIES include the supervision of African and European staff installing and maintaining several types of wireless equipment, particularly V.H.F. single and multi-channel.

Appointment is either pensionable on probation in the salary scale £910 × £40 to £1,560 p.a. or on contract in the salary range £1,116 × £48 to £1,898 p.a., with a gratuity of £100-£150 per annum on satisfactory completion of contract.

Free passages are provided for the officer, his wife, and an annual maintenance allowance or free passage allowance of £75 each is payable in respect of a maximum of two children. Leave is granted at the rate of 7 days for each month of resident service. Government quarters are provided if available at a low rental.

Candidates must have passed or be exempt from Parts A and B of the examination for Associate Membership of the Institution of Electrical Engineers, or hold a university degree in electrical engineering, with telecommunications specialisation, or be Assistant Engineers in the British Post Office with considerable experience in telecommunications practice. Detailed experience of the installation and maintenance of V.H.F. single and multi-channel wireless equipment and varied experience of modern telecommunications practice is necessary.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St., London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD.108/14/05. 3883

WEST RIDING COUNTY COUNCIL

Castleford, Whitwood Mining and Technical College

REQUIRED for September, 1954, or as soon thereafter as possible: ENGINEERING DEPARTMENT ASSISTANT, GRADE A, to teach Electrical Engineering subjects and Mathematics to Ordinary National Certificate standard. Applicants should have had good experience in electrical installation or mining electrical work.

Salary in accordance with the appropriate Burnham Technical Scale.

Application forms obtainable from the undermentioned should be returned within 14 days of the appearance of this advertisement to

M. G. SWAINE.

2, Wesley Street,
Castleford. 3854

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Ref. 149/2/DR/AJW. Vacancy No. 66/54

APPLICATIONS invited for the following superannuable N.J.B. appointments in the Divisional Drawing Office, Construction Department. Salary Schedule D, Grade 6 (£433-£567 per annum).

1. ENGINEERING DRAUGHTSMAN (Transmission). Candidates should have experience in one or more of the following:—
   (i) Layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers and cables.
   (ii) Overhead lines.
   (i) Protective gear systems.
2. ENGINEERING DRAUGHTSMAN (Mechanical). Candidates should have experience in one or more of the following:—
   (i) Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant, and general station auxiliaries.
   (ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
   (iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 12th July, 1954.

21st June, 1954. 3924

ELECTRICITY SUPPLY BOARD, IRELAND

VACANCIES for: (A.) MECHANICAL OR ELECTRICAL ENGINEERS. (B.) GRADUATES OF I.Mech.E. OR I.E.E.

(A.) Vacancies exist in the Board's Engineering Departments—Generation, Transmission, Distribution, Operation and Sales—for qualified electrical/mechanical engineers. The initial salary scale is £540 to £980 per annum, with higher entry point for those with suitable post-graduation experience or special qualifications.

The Board's extensive programme of expansion in all its Engineering Departments offers favourable opportunities of early promotion to higher grades. The first promotional grade carries a salary scale of £782-£1,061 p.a.

(B.) Vacancies also exist for which Graduates of the Institutions of Mechanical or Electrical Engineers will be considered, salary scale and starting salary being related to experience.

Applications, with details of age, qualifications and experience, should reach the Personnel Officer, 27, Lower Fitzwilliam Street, not later Thursday, 8th July, 1954.

PATRICK J. DEMPSEY,
Secretary.
3911

EASTERN ELECTRICITY BOARD

Essex Sub-Area

Junior Engineer, Southend District (89/54.R.)

CANDIDATES should have had a sound technical education, preferably to Higher National Certificate standard and some experience of H.V and L.V. distribution systems.

Salary will be in accordance with Class F, Grade 1b of the National Joint Board Salary Agreement commencing at £402. Future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the District Manager, Southend, Eastern Electricity Board, 85, London Road, Southend, Essex, within fourteen days of the appearance of this advertisement. 3904

BRITISH INSULATED CALLENDER'S CABLES LTD.

invite applications for the following vacancies at their Leigh Works, Nr. Manchester:

GRADUATE PHYSICISTS or ELECTRICAL ENGINEERS for the Electro-Physical Laboratory. The work involves the study of electrical properties of rubber and synthetic insulating materials under a wide range of physical conditions. Investigational work relates to the performance of experimental cables embodying new and improved designs. Candidates should have an interest in the practical use of all types of electrical measuring equipment, but previous industrial experience is not necessary. Ref. A/26/54.

GRADUATE PHYSICISTS for Development Laboratory and Pilot Plant. The positions provide splendid opportunities for recently qualified men, who need not have had previous industrial experience. The investigational work involves modifications to existing processes as well as the development of new and improved techniques and designs. A flair for designing and constructing pieces of special equipment with which to conduct experiments would be an advantage but is not essential. Ref. A/3/54.

Applications in writing, quoting the appropriate reference, should be addressed to—The Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. 3841

CITY OF BIRMINGHAM EDUCATION COMMITTEE

Handsworth Technical College

Principal: Herbert Marshall, B.Sc.Tech., A.M.I.Mech.E., A.M.I.P.E.

A FULL-TIME ASSISTANT, Grade A, is required for 1st September, 1954, to teach in Electrical Trades Courses. The work will include electrical workshop practice and processes, electrical science, drawing and calculations. Candidates should have had suitable works experience in electrical manufacture or maintenance and should possess a National Certificate in Electrical Engineering. Part-time teaching experience is desirable.

Salary in accordance with the Burnham (Further Education) Scale for Assistants, Grade A (men) £415-£18-£670 (at present under review) plus allowances for graduate qualification and training where applicable. In fixing the commencing salary allowance will be made for approved industrial experience.

Further particulars and form of application will be forwarded by the Principal on receipt of a stamped addressed envelope.

E. L. RUSSELL,
Chief Education Officer.
June, 1954. 3852

TECHNICAL BRANCH MANAGER

WELL-known company manufacturing the highest grade motors, rotating electrical machines up to 10,000 b.h.p., transformers, rectifiers, H.T. and L.T. switchgear, hand-operated and automatic motor control gear, require the services of a first-class TECHNICAL BRANCH SALES MANAGER.

Applicants should have a sound practical and technical training, and preference will be given to one having a good connection with the heavy industries in the Middlesbrough area.

Remuneration will be on a generous scale, expenses and car being provided by the company. All applications will be treated in strict confidence. Pension scheme available.

Apply, giving full details of technical and sales training to—Box 3884.

THE ROYAL TECHNICAL COLLEGE, GLASGOW

Affiliated to the University of Glasgow

Department of Electrical Engineering

APPLICATIONS are invited for a LECTURESHIP IN THE DEPARTMENT OF ELECTRICAL ENGINEERING. Applicants should hold a degree or equivalent qualification and have had some industrial experience, preferably in the field of Electrical Measurements. The duties of the post include both teaching and research. The salary is on a scale £600—£50—£1,150. Forms of application may be obtained from the Secretary, George Street, Glasgow, C.1. 3909

CITY OF LEICESTER EDUCATION COMMITTEE

College of Technology and Commerce

The Newarke, Leicester

Principal: R. E. Wood, M.Sc., F.Inst.P.

APPLICATIONS are invited for the post of ASSISTANT LECTURER, GRADE B, in the Electrical Engineering Department, for Ordinary National Certificate and (mainly) Electrical Installation courses.

Candidates should possess a Higher National Certificate or equivalent qualification and have had adequate practical experience in electrical installation work and some teaching experience; they should be capable of teaching up to City and Guilds B and C Certificate standard.

Salary, Burnham Technical Scale, Grade B, £490 × £25 to £765 per annum, with allowances for approved industrial experience.

Application form and further particulars obtainable from the Registrar, to whom completed forms should be returned as soon as possible.

ELFED THOMAS,
Director of Education.
3878

EAST RIDING OF YORKSHIRE COUNTY COUNCIL

Appointment of Electrical Engineering Assistant

APPLICATIONS are invited for the appointment of an ELECTRICAL ENGINEERING ASSISTANT on the staff of the County Architect's Department, at a salary in accordance with A.P.T. Grade II (£520-£565 per annum).

Candidates will be required to provide evidence of satisfactory experience in the employment of an electrical contractor or local authority, and in the design, supervision and maintenance of electrical installations.

The appointment is superannuable and subject to the passing of a medical examination.

Applications, giving particulars of age, training, qualifications, experience, past and present employment (with salaries), and accompanied by copies of three recent testimonials, should be addressed to the County Architect, County Hall, Beverley, and must be received by him not later than Friday, 9th July, 1954.

THOMAS STEPHENSON,
Clerk of the Council.
County Hall,
Beverley.
June, 1954. 3880

DRAUGHTSMEN

IMPERIAL CHEMICAL INDUSTRIES LIMITED, Wilton Works, near Redcar, has further openings for Draughtsmen in the following categories:—

MECHANICAL DRAUGHTSMEN

ELECTRICAL DRAUGHTSMEN

INSTRUMENT DRAUGHTSMEN

Applicants should possess the appropriate National Certificate. Appointments are to the permanent staff, 5-day/39-hour week, with first-class working conditions including pension fund and recreation facilities.

Write for application form to Staff Officer, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, or apply to the nearest Employment Exchange quoting advertisement reference ICI/X/186/g. 3913

CABLE INSTALLATION ENGINEERS FOR AUSTRALIA

ASSISTANT ENGINEERS required for cable installation work for permanent service in Australia with large Cable Manufacturing and Contracting Company.

Salary according to qualifications and experience.

Applicants will receive a period of training in the United Kingdom before appointment confirmed.

Apply, stating age, qualifications and experience to, Box 3912.

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside and North Wales Division (Merseyside and N. Wales)

APPLICATIONS are invited for the position SENIOR ASSISTANT ENGINEER (Mechanical) in the Construction Department, Springwood House, Woolton, Liverpool. Salary £970/£1,103 per annum, N.J.B. Class AX, Grade 1, Schedule C. The appointment is superannuable and subject to medical examination.

Applicants should preferably be Chartered Mechanical or Electrical Engineers with experience in the design and construction of modern power stations. The successful applicant will be responsible to the Generation Engineer (C) for the design and construction of new, or extensions of existing, power stations, including preparation of specifications, checking tenders, handling contracts and the general supervision of work on site.

Application forms may be obtained from the Divisional Controller, Beaconsfield Road, Woolton, Liverpool. Closing date 9th July, 1954. 3840

MINISTRY OF SUPPLY

DRAUGHTSMEN required by Ministry of Supply at various locations, with experience in any of the following classes of work: Chemical plant, light or heavy mech., automobile, precision instrumentation, radio, radar, electrical, electronics, structural, building, jig and tool. At least 3 years' workshop training and O.N.C. or equivalent.

Starting pay (Provincial) £380 (age 20) to £550 (age 28), rising to £640. London rates higher. Paid sick leave; 20 days' annual holiday plus public holidays; 44-hour week (generally 5-day), including meal breaks. Payment for overtime. Appointments unestablished but opportunities to compete for pensionable posts.

Prospects of promotion to Leading Draughtsman, £635-£742 (prov.), thence to Senior Draughtsman, £742-£910 (prov.), and Chief Draughtsman, £960-£1,120 (prov.).

Write stating age, training, qualifications and experience to Ministry of Supply, Est. 3(c)1, Room 519, Carlton Hotel, Haymarket, London, S.W.1. 3823

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post: JUNIOR ENGINEER, LUTON GENERATING STATION.

Salary Class E, Grade 15, £390, to Grade 14, £445 per annum depending on qualifications, etc.

Duties include operation of A.C. and D.C. plant on shift and technical assistance of boilers and turbines, and provides experience useful for subsequent promotion.

Applicants should have had training or experience in similar work. Technical training to Ordinary National Certificate standard, or equivalent, and experience or knowledge of rotary converting plant will be an advantage.

Applications, stating age, qualifications and experience, to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London, N.14, by 17th July, 1954.

W. N. C. CLINCH,
Controller. 3876

THE BELMOS COMPANY LIMITED

Bellshill, Lanarkshire

Research Engineers

APPLICATIONS are invited for appointments to the staff of a research unit for work on problems associated with control gear, contactors and low-voltage switchgear. Candidates should have a good honours degree, and have completed a period of postgraduate industrial training. Preference will be given to those who have had some experience in an appropriate field of engineering or in experimental research.

Salaries will be commensurate with qualifications and experience, which should be stated in letters of application addressed to the Managing Director. 3856

VERSATILE ENGINEER REQUIRED

WE want a good, energetic technical Electrical Engineer. This situation demands a works trained, fully experienced man with a modern outlook, capable of making decisions and taking responsibility. Above all, he must not have a "single track mind" and must have commercial vision.

Duties include design and development of all types of automatic control gear for engine-driven electric generating equipment up to 150 kVA, preparation of detailed technical specifications for tenders, correspondence in regard to technical queries, and compiling instruction and service manuals for a large range of sets.

An attractive salary plus bonus on trading will be paid to the right man, and a pension scheme is in operation. Our employees are aware of this advertisement.

All replies will be treated in strictest confidence. Send full details of training, experience, positions held, duties, qualifications, age and approximate salary range to—Box 3724.

BRITISH ELECTRICITY AUTHORITY

Headquarters, London

SENIOR ASSISTANT ENGINEER required in the Co-ordination Sub-Branch of the Generation (Station Construction) Sub-Department to co-ordinate construction work at a group of power stations. Candidates should preferably be Corporate Members of the I.Mech.E. or I.E.E., and practical experience in construction of modern power stations including handling of contracts, preparation of commissioning programmes, work on site and co-ordination of projects from inception to commissioning is essential.

Salary N.J.B. Grade 1, £1,002-£1,378 p.a. inclusive.

Applications stating age, qualifications, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 16th July, 1954. Quote reference ER/492. 3906

ADMIRALTY—ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required in Experimental Establishments in London, Portsmouth, Weymouth and Gloucestershire areas and Scotland. The majority of posts are for Engineers and Physicists (particularly with Electronics).

Candidates must be British subjects with an appropriate first or second class honours degree or equivalent high professional attainments.

Salaries: S.S.O. (M) £975-£1,150; S.O. (M) £470-£855. London rates. Somewhat lower in Provinces. All appointments are unestablished (with F.S.S.U.), but with some opportunities to compete for established posts.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A.246/52/A. 3723

CONTACTOR SWITCHGEAR LTD.

ENGINEERS required for both Engineering and Estimating Departments for control gear applications up to 1,000 h.p., low and high tension.

The company operates a contributory pension scheme and will share cost of removal in approved cases.

Applicants should have completed their National Service and preferably be not over 45.

Write in confidence to the Secretary, Moorfield Road, off Upper Villiers Street, Wolverhampton. 3855

KENT COUNTY COUNCIL

Senior Electrical Engineers

APPLICATIONS are invited from Chartered Electrical Engineers for two appointments as above. Applicants must have had good experience in the preparation of schemes, specifications and estimates for electrical installation work. Salary within the range £695-£860 a year according to experience.

Further details and forms of application obtainable from the County Architect, Springfield, Maidstone. 3882

RADIO TECHNICIAN

required as SIGNALS ASSISTANT INSPECTOR OF POLICE by NYASALAND GOVERNMENT for one tour of 2-3 years with prospect of permanency. Salary, etc., £651 rising to £1,103 a year. Commencing salary according to experience. Outfit allowance £50. Uniform allowance £10 a year. Free passages. Liberal leave on full salary.

Candidates must be between 21 and 30 years of age, of good education and physique, not below 5' 7" in height, normal vision without glasses. They must have a sound knowledge of H.F. and V.H.F. fixed and mobile simplex and duplex radio telephone systems and low-power petrol/electric charges and alternators. Knowledge of Morse and ability to instruct trainees in radio subjects desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M1/36023/EF. 3851

SOUTHERN ELECTRICITY BOARD

Demonstrator

SUNNINGHILL Branch, Staines District of No. 1 (Southall) Sub-Area. Salary N.J.C. Grade 1 (£400/£490 per annum). N.J.C. conditions of Service.

Applicants should be women who are qualified to advise generally on the utilisation of electric domestic appliances, and to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate, or equivalent Domestic Science qualification would be an advantage.

The successful candidate will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, and returned to him not later than 16th July, 1954. 3910

BRITISH ELECTRICITY AUTHORITY

Midlands Division

OPERATION AND EFFICIENCY ENGINEER is required at Nechells B Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J5 of the Agreement, commencing at £942 per annum.

A wide knowledge of and experience in the operation and maintenance of a large generating station are essential, and the successful applicant will be responsible for the efficiency of the power station plant. Appropriate qualifications will be an advantage.

Apply, quoting Vacancy No. 699MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 17th July, 1954. 3908

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

MAINTENANCE ENGINEER, Croydon "A" Power Station. Applicants should have had a sound technical education with experience in the maintenance of high-pressure turbine and boiler plant, electrical plant and all power station auxiliary plant. Corporate membership of any of the recognised professional institutions will be an advantage. N.J.B. conditions of service, Class F, Grade 5, £830 11s. p.a., including London allowance.

Applications, giving details of education, present position, experience, etc., should be received by the Station Superintendent, Croydon "B" Power Station, Beddington Park Rd., Croydon, Surrey, by 9th July, 1954. 3877

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT of ENGINEERING DRAUGHTSMAN (ELECTRICAL), SUB-AREA TECHNICAL ENGINEER'S DEPT., MANCHESTER. Applicants should have had a suitable technical education and good drawing office training; experience of distribution network equipment would be an advantage.

Salary scale £433/£567 p.a., Schedule D, Grade 6, N.J.B. conditions.

Applications to Sub-Area Secretary, No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 10th July, 1954. 3879

THE POLYTECHNIC

309, Regent Street, London, W.1

THE Governors invite applications for the post of HEAD OF THE ELECTRICAL ENGINEERING DEPARTMENT, duties to commence as soon as possible.

The post is recognised as a Grade 3, Heads of Departments, Burnham (Further Education) Scale appointment. Salary scale £1,190 rising by annual increments of £25 to a maximum of £1,390, plus London allowance of £36 or £48 per annum.

Applicants should possess a good honours degree and have had both teaching and professional experience.

Further particulars and form of application, which should be returned by 31st July, may be obtained by sending a stamped addressed foolscap envelope to the undersigned.

J. C. JONES,
Director of Education. 3867

A FIRM handling medium-powered electrical capital equipment requires the services of an energetic sales manager with wide experience of both home and export trade. Full details to —Box 3914.

A WELL-known company manufacturing electric water heaters is expanding its sales force and wishes to recruit a number of representatives for various parts of the country, preferably aged 25-35. Previous experience in this field of selling desirable but not essential. Initial salary £500-£600 according to qualifications, with plenty of scope for advancement. Applications should be in own handwriting giving full details of education, experience and age —Box 3916.

ALKALINE BATTERIES Ltd., of Redditch, are the largest makers in the Empire of alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its technical sales and development sections for graduate electrical engineers, not over 30 years of age, or for men nearing the end of their degree course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed —Commercial Manager, Alkaline Batteries Ltd., Union Street, Redditch. 3946

AN industrial organisation has a number of interesting vacancies for mechanical and electrical engineers. Applicants should be between 21 and 27 years of age and should hold an honours degree. Starting salaries in the range of £600 to £900 per annum depending upon qualifications and experience. Appropriate practical training will be arranged where necessary and normal salary will be paid during this period. Write, giving full particulars of age, qualifications and experience, to Box 3843, quoting advertisement reference O.6.

AN opportunity occurs in progressive manufacturing concern in London area for engineer aged 25/35 with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply giving full particulars to—Box 3885.

ASSISTANT chief engineer required by company engaged in the design and development of guided weapons. Candidates must be mechanical engineers with first-class qualifications and experience in electronics and light engineering. Knowledge and experience in servo-mechanisms essential since duties would include responsibility for missile control systems, electrical gyros, accelerometers, etc. Applicants should be 30-35 years of age and have sufficient personality and experience to administer and organise the development activity on these subjects. Write in detail, quoting reference G, to—Box AC.91032, Samson Clarks, 57/61, Mortimer Street, London, W.1. 123

ASSISTANT foreman required. To supervise the assembly and wiring of automatic control gear. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme, 5-day week, canteen. Details of age, experience, qualifications and commencing salary to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3576

AUTOPHONE Ltd., require qualified assistant engineer (degree or equivalent) for interesting and varied work on telephone and electronic equipment. Drawing office and workshop experience essential. Write fullest particulars to—539, Wandsworth Road, London, S.W.8. 3915

BRANCH manager required for Lancashire by national electrical wholesaler for established branch. Applicants should have had previous experience in a similar sphere, be sound administrators and capable of developing an expanding branch. Remuneration by salary, commission and expenses. Superannuation scheme.—Box 3886.

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Company Ltd., 24, Fennel Street, Manchester, 4. The company requires additional electrical plant inspectors in various districts. Permanent positions carrying progressive salary scale £540 to £785 and non-contributory pension. Candidates, age 26 to 30 years, with apprenticeship in the manufacture or repair of electrical machinery, and preferably with subsequent experience of industrial use of electrical machinery, and who have gained the Higher National Certificate in Electrical Engineering or are Graduates of the Institution of Electrical Engineers, are invited to apply in own handwriting stating age, qualifications and experience. 3887

BRUSH ELECTRICAL ENGINEERING Co. Ltd. are requiring draughtsmen for their electrical rotating machines d/o. Candidates should be fully experienced mechanical draughtsmen, preferably with some experience of A.C. and D.C. machines. The conditions of service include a non-contributory staff pension scheme, and there are good prospects of advancement. Please apply with full details of training, experience, age, salary, etc., to—The Chief Personnel Officer, Brush Electrical Engineering Co. Ltd., Loughborough, Leics. 3845

CAPABLE experienced man to take charge of electrical sales dept. of well-known E.W.F. Wholesalers (B'ham). Able to deal with quotations, correspondence and all matters pertaining to inside sales. High remuneration and ample scope for ability and initiative. Full details of experience to—Box 3888.

COMMISSIONING engineers required by a well-known firm of consulting engineers. Duties will involve the commissioning of new boilers, turbo-alternators and power station plant, and in some cases these plants are situated overseas. Candidates will have to be prepared to attend foreign sites for short periods to commission plant. Applicants must have had a number of years' experience in the operation of power plant, and experience with diesel engines would be an advantage. The salary offered will be in accordance with the applicant's experience and qualifications. Applications should be forwarded to—The Personnel Officer, Ewbank & Partners Ltd., 10/11, Grosvenor Place, London, S.W.1. 3761

CONTRACTS engineers required for handling of switchgear tenders and contracts. Applications should state age, experience, qualifications and salary required, and should be addressed to—The Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. 3775

CONTROL gear designers required for manufacturers in South Midlands. Applicants should have knowledge of motor and machine characteristics and some control gear experience. Salary depending on qualifications. Staff pension scheme in operation. Reply giving full details of training and experience to — Chief Engineer, Igranic Electric Co. Limited, Bedford. 3825

CROMPTON PARKINSON Ltd., Chelmsford, require person capable of dealing with enquiries and orders for automatic and manual starters and control gear, including automatic voltage regulators for use with a wide range of A.C. and D.C. motors and generators. Superannuation scheme, extensive sports, social and welfare facilities. Write, stating age, present salary, etc., to the Personnel Officer. 3683

DRAUGHTSMAN (junior) required by The General Electric Co. Ltd., for work connected with industrial heating, cooking and baking schemes. Applicants should not be older than 27 years of age, with O.N.C. standard and preferably some experience in this type of work. The position offers opportunities for progress with the sales organisation of the company. Apply in writing, quoting reference I.H., to the Staff Manager, Magnet House, Kingsway, London, W.C.2. 3919

DESIGN draughtsman. A vacancy exists in our design drawing office for a first-class designer draughtsman for interesting work associated with the development of automobile electrical equipment. He should be at least of H.N.C. standard, and experience in the design of light electrical equipment for large quantity production would be an advantage. The post provides excellent scope for initiative and advancement. Reply stating qualifications, experience and age, to Personnel Manager, Joseph Lucas Ltd., Great King Street, Birmingham, quoting reference PM/D/93. 3920

DESIGN draughtsman required for M.V. and E.H.V. switchgear; H.N.C. or equivalent. Salary commensurate with qualifications. Pension scheme. Apply—Chief Engineer, J. G. Statter & Co. Ltd., Amersham Common, Bucks, marked Confidential. 3796

DESIGNER-draughtsman required for design and development of test gear to meet production demands of thermionic valves and cathode ray tubes. Applicants should have good mechanical knowledge with previous experience in mechanical and electrical interlocks, component layouts for power supply units up to 50 kV, 50 cycles, and R.F. or induction heaters. Housing facilities available near factory area. Write stating age and full details of previous experience and technical training to—The Edison Swan Electric Company Ltd., Eastern Industrial Area, Harlow New Town, Essex. 3826

DRAUGHTSMAN required at the Rugby works of the British Thomson-Houston Co. Ltd., for layout and detailing of A.C. and D.C. motors and generators. Experience not essential. Progressive position for man of initiative. Apply to—Chief Draughtsman, Motor Drawing Office, The British Thomson-Houston Co. Ltd., Rugby. 3739

DRAUGHTSMAN required for detailing mechanical and electrical assemblies. Must be capable of reading electronic circuits. Applicants with any previous experience on sheet metal cubicles, H.V. power supply units, induction heaters or radio and television layouts should write, stating age and full details of previous experience and technical training. Housing facilities available near factory area. —The Edison Swan Electric Company Ltd., Eastern Industrial Area, Harlow New Town, Essex. 3827

DRAUGHTSMAN required for switchgear development work. Good salary offered to suitable applicant. Pension scheme available. Reply stating age, salary, full details of technical qualifications and experience to—Erskine, Heap & Co. Ltd., Lancashire Switchgear Works, Salford, Manchester, 7. 3654

DRAUGHTSMAN wanted by makers of industrial electrical control gear. London area. Full details, experience, age, salary, to —Box 3844.

DRAUGHTSMAN / designer to prepare original designs of contemporary fluorescent and tungsten lighting fittings. Applicants must be capable of conceiving the design and of supervising the production of prototypes from their drawings. Please write—Personnel Dept., Harris & Sheldon (Electrical) Ltd., Ryder Street, Birmingham, 4. 3857

DRAUGHTSMEN. Igranic Electric Co., being desirous of increasing the size of its control gear drawing office, invites application for positions as senior and junior draughtsmen. Apply to—Chief Engineer, Igranic Electric Co. Ltd., Bedford. 3824

DRAUGHTSMEN. Openings will arise in the immediate future for a number of senior design draughtsmen, draughtsmen, and detailers who desire to progress in electronic engineering, as applied in the rapidly expanding field of VHF and UHF radio communications equipment. Pension scheme, good salaries, and excellent conditions, at newly developed works and laboratories in the South West Middlesex area. Own staff informed. Please write giving full particulars of experience, qualifications, and when available, to—Box 3921.

DRAUGHTSMEN. Previous experience in motor control equipment circuit work helpful but not essential if applicants are up to O.N.C. standard. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details of age, experience, qualifications and commencing salary to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3449

ELECTRICAL designers and draughtsmen required permanently. Experience in lighting and power installations for schools, hospitals and other large institutions. Five-day week. Excellent prospects. Interview expenses refunded. Confidential applications to—E. G. Phillips Son & Norfolk, Consulting Engineers, Arskus House, Annesley Grove, Nottingham. 3596

ELECTRICAL draughtsman required Park Royal area. Should have experience in lighting and power installations for retail shops, manufacturing and processing depots; 5-day week; canteen. Good salary for suitable man. Pension scheme. Apply in writing, stating age and experience, etc., to—United Dairies Engineering Department, Cumberland Avenue, Park Royal, London, N.W.10. 3858

ELECTRICAL draughtsman, 25-30, preferably familiar with heavy industrial plant, practice and layout. Knowledge of distribution systems up to 3,300 volts. A.C. and D.C. motor control schemes and preparation of schematic diagrams. Salary depending on age and experience. Superannuation scheme. Applications to be received by 19th July addressed to—Electrical Engineer, Guest Keen Iron & Steel Works, Cardiff. 3617

ELECTRICAL engineer, age 25-30, with good degree, preferably some experience in a research or development laboratory, is required for work on the application of electronic techniques to industrial measurement and control. This post is permanent, pensionable and offers good prospects. Apply in writing, giving full chronological details of qualifications and experience, together with age and salary required, to—Tube Investments Ltd., Dept. of Development and Research, Plume Street, Aston, Birmingham, 6, quoting ref. F.2. 9982

ELECTRICAL engineer for sales. Midland Silicones Ltd., an associated company of Albright & Wilson Ltd., require a qualified electrical engineer as assistant manager of the electrical department in the London office. The duties comprise the marketing of silicones to the electrical industry and provide great scope for the use of energy and initiative. Some travel is involved. H.N.C. in electrical engineering is a minimum qualification. Considerable experience in the use of insulating materials would be an advantage. Age 25-35. Good commencing salary and membership of non-contributory pension scheme. Apply to—The Appointments Officer, Albright & Wilson Limited, Oldbury, Birmingham. 3828

ELECTRICAL sales engineer required for the Manchester area by a well-known engineering company for the purchase and sale of electrical machinery. Applicants should please submit details of previous career in chronological order to—Box 3798.

ELECTRO-mechanical draughtsmen required. Applicants should be up to O.N.C. standard. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details age, experience, qualifications and commencing salary to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3450

ELECTRONICS. Electrical testers required who must hold O.N.C. or equivalent. Also required men with radio, radar or television experience for wiring and assembly of trays and panels. Please write or call—The Employment Office, The British-Thomson-Houston Co. Ltd., Rugby. 3829

ENGINEER or practical physicist required to supervise a laboratory section concerned with routine performance testing of electrical components to Government and industrial specifications.—Dubilier Condenser Co. (1925) Ltd., Victoria Road, N. Acton, London, W.3. 3763

ENGINEERS who wish to broaden or commence career as electronic engineers in a field of great interest and variety and involving latest techniques can avoid restrictive specialisation by joining Marconi Instruments, who produce light current communications, measuring and test apparatus for a wide range of requirements. We have positions for men of degree standard and experience, also City and Guilds Telecommunications Certificate standard, or compensating experience and natural aptitude for electronic engineering. Holiday arrangements if fixed can be held. Saturday interview, if required. Applications in strictest confidence. Apply—Marconi Instruments Ltd., Longacres, Hatfield Road, St. Albans. 3637

ELECTRO-acoustics development and design of small electrical mechanisms and mechanical devices. Vacancies exist in a large electrical engineering concern in London. Degrees in electrical or mechanical engineering or physics required. Holders of H.N.C. or H.N.D. (Electrical) will be considered. Permanent positions with good working conditions and non-contributory pension. Good prospects for advancement. Write Box 3846, giving qualifications, experience and present salary.

ESTIMATOR for indoor sales staff required by Crompton Parkinson Ltd., Chelmsford. Applicants must have initiative and be experienced in dealing with enquiries relating to A.C. and D.C. rotating electrical machinery up to 1,500 h.p./kW. Superannuation scheme, and extensive social, sports and welfare facilities. Write, giving fullest particulars, to the Personnel Officer. 3682

EXPERIENCED transformer designer, conversant with high-voltage power transformer practice, required. The vacancy offers great opportunities to a person with initiative and drive. Good salary and pension scheme. Accommodation available. Apply giving full particulars of past experience to—Box 3597.

GRADUATE electrical engineer with recognised apprenticeship required to undertake and ultimately be responsible for investigational test work on high-voltage apparatus, Manchester district. Please state details of training and experience and salary expected to—Box 3859.

HIGHLY skilled electrician required for small contractors. Prepared to reside in East Coast town. Excellent prospects for advancement.—Box 3619.

IMPERIAL COLLEGE. Applications are invited for lecturers in electrical engineering from 1st October, 1954. Salary scale £600 × £50 to £900; × £50 to £1,150. Initial salary according to experience and qualifications. F.S.S.U. and family allowances. Candidates should possess a good honours degree in electrical engineering. The duties will include undergraduate and postgraduate teaching and research.

Applications, stating age, academic qualifications and experience, together with names of two referees, should reach the Head of the Electrical Engineering Department, City and Guilds College, London, S.W.7, not later than 30th July, 1954. 3889

JOHNSON & PHILLIPS require an estimator and technical correspondent in their transformer department. Preference will be given to a man experienced in the preparation of tenders for the home and export market. Applications giving particulars of training and experience, together with age and salary required, to—Employment Manager, Johnson & Phillips Limited, Charlton, London, S.E.7. 3623

JOINTER E.H.T. required by the South Wales Electricity Board at their Construction Department, Dulais Depot, Pontardulais, near Swansea. Wages 3s. 9d. per hour for a 44-hour, five-day week. Applicants must have had experience in jointing and handling all types of cable up to 33,000 volts. Applications stating age, education, experience in present and previous positions, etc., to be addressed to the Sub-Area Manager, South Wales Electricity Board, Ystrad Road, Fforestfach, Swansea, to reach him not later than Friday, 9th July, 1954. 3922

JOSEPH LUCAS Ltd. have vacancies in their design drawing office for several first-class mechanical designers for work on small motors and switchgear. Applicants should be up to H.N.C. standard and it is desirable that they should have experience in designing for quantity production. The positions are permanent and pensionable and offer excellent opportunities to men possessing initiative and originality. Please reply, stating experience, qualifications and age, to—Personnel Manager, Joseph Lucas Ltd., Great King Street, Birmingham. 142

JUNIOR transformer designer required for interesting work in the design of power transformers, regulators and associated control gear. Previous design experience desirable. Excellent prospects for the right candidate. Apply—Brentford Transformers Ltd., Kidbrooke Park Road, London, S.E.3. 3598

LIGHTING sales engineer with interest in specialised lighting for responsible position in London area. Good technical knowledge and ability to discuss architects requirements essential. Write stating age, qualifications and experience, to—Box 3918.

MAINTENANCE electrician large factory Greenford area, experience with D.C. motors and control gear a recommendation; permanent situation. Write fully—Box 3657.

MAJOR oil company requires one electrical engineering draughtsman for work in London. Age 25 to 30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualification. Good practical experience required followed by 3 to 5 years in the drawing office on electrical installations for process plants, workshops and factories. He will have opportunities of visiting refineries for periods of temporary duty. Opportunities for promotion to engineering appointments occur within the company and with its associates both in the U.K. and overseas. Write giving full details and quoting H.2067 to—Box 6761, c/o [illegible]91, Gresham House, London, E.C.2. [illegible]62

MANAGING director of small old-established electrical contractors in Manchester district requires personal assistant. Excellent opportunity for well-trained practical engineer. Apply giving full details and salary required. All applications will be treated in confidence. —Box 3861.

PLUMBER-jointers required for work in Home Counties. Good conditions and permanent employment.—Box 3830.

PRODUCTION development engineer. The English Electric Company Ltd. require a fully qualified engineer at their Luton works to take charge of a department responsible for carrying out investigation work into new methods of the manufacture in the light electro-mechanical field. The successful applicant will have sound practical training and possess a thorough knowledge of the latest manufacturing methods. This is a senior appointment, providing facilities for practical production research work, carrying a salary commensurate with the responsibilities involved, and with housing assistance if required. Applications, which will be treated in strict confidence, should be addressed to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting ref. 900A. 5631

PRODUCTION supervisor. A vacancy offering scope for progress is available for suitable applicant having experience in production of tape and wire-wound electrical elements and a good knowledge of electrical domestic appliances. Commencing salary £850. Write giving full details of past experience, age, etc., to—Box 3744.

PURCHASING officer required with sound experience in purchasing wide range of materials for mechanical and electrical engineering trades. Pension scheme; house available. Apply, stating age, experience and salary required, to—The Secretary, E. R. & F. Turner Ltd., Foxhall Works, Ipswich, Suffolk. 3847

QUALIFIED electrical engineer or physicist required for work on the design and utilisation of rubber and plastic cables for a wide variety of applications, mainly for power distribution in coal mines, aircraft, ships, etc. The position offers good opportunities for further advancement.—Box 3842.

QUALIFIED engineer, wide experience, required as assistant to chief engineer of company producing extensive range of engine-driven equipment. Capacity 5-250 h.p. Knowledge of design and development in connection with generator, compressor and pumping applications. Commencing salary and bonus approximating to £1,000 per annum, compulsory pension scheme. Excellent prospects. West Middlesex.—Box 3802.

REPRESENTATIVE required by well-known domestic appliance manufacturers to cover the Midlands and North, including Manchester, Leeds, etc. Wide experience of the wholesale trade, electricity boards and local authorities essential. Remuneration by salary, commission and expenses. Must be car owner. Position offers vast scope to successful applicant.—Box 3863.

SALES clerks required by electrical distributors; 5-day week; pensionable position. State age, experience and salary required to—Box 3848.

SALES manager required for electrical wholesale firm (E.W.F.). Current experience in similar business is essential and applicants should have wide range of personal contacts. Applications, which will be treated with strict confidence, to—Managing Director, Box 3834.

SALES engineer required by old-established company. Applicants should be acquainted with E.H.T. overhead steel tower transmission line equipment, also district distribution systems. Although the operation centre is London, applicants must be prepared to travel over Great Britain. Apply stating age, education, experience and salary expected, to—Box 9985

SWITCHGEAR draughtsman, experienced in layout and diagram work for general contract work, required by electrical engineering company, Manchester area. Good conditions and prospects. Please state experience, age and salary required to—Box 3890.

SWITCHGEAR engineer. Switchgear engineer to deal with enquiries and orders for H.T. and L.T. substation switchgear at head office. Some previous similar experience an advantage. Reply stating qualifications and experience to—Personnel Manager, Ferguson Pailin Ltd., Higher Openshaw, Manchester, 11. 3860

TECHNICAL assistant required for handling enquiries, tenders, specifications and general technical matters regarding power cables, including supertension. Age 25-30. Applicants should have good technical background with H.N.C. or equivalent. 5-day week. Pension scheme. Apply to—Secretary, W. T. Glover & Co. Ltd., Trafford Park, Manchester, 17. 3864

TECHNICAL assistant required for training as a lamp works engineer. Initial work will be on preparation of specifications. Every opportunity will be given for advancement on technical side. Applicants with O.N.C. or equivalent should write to—Personnel Officer, Osram-G.E.C. Lamp Works, Hammersmith, London, W.6. 3923

TENDERING engineer required by manufacturers of electrical rotating machinery. Previous experience in this field is essential and education to O.N.C. standard desirable. Five-day week; non-contributory staff assurance scheme. Salary according to qualifications and experience.—Box 3891.

TESTER required for automatic control gear. Good salary and prospects. For successful applicants requiring housing accommodation assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details of age, experience, qualifications and commencing salary to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3575

THE GENERAL ELECTRIC Co. Ltd. have vacancies on the staff of their sales organisation in London for young men of Ordinary National Certificate standard in Electrical Engineering. Excellent opportunities for promotion exist for those interested in sales of most types of electrical equipment and in work on the drawing board. Applicants, having drive and initiative, should have had a sound general education and preferably previous experience in a sales organisation. Apply in writing, quoting reference "Gen," to—The Staff Manager, Magnet House, Kingsway, London, W.C.2. 3803

THE IRAQ PETROLEUM Company invites applications for the post of assistant lecturer in electrical engineering at the Industrial Training Centre at Kirkuk, which provides training for Iraqi apprentices in technical subjects to O.N.C. standard. Candidates should have degree or H.N.C., but essentially with practical engineering as well as teaching experience; desirably Teacher Training Course; previous overseas teaching experience an advantage as students' knowledge of English is necessarily limited. Applicants, under 35, should be ready to take up appointments in September. Pensionable emoluments commencing from £900 (incremental), in addition to which there are further allowances varying from £432 p.a. to £720 according to family circumstances. Annual leave with paid passages. Accommodation, which is provided by the company, is limited, and therefore married applicants must be prepared for an initial period of family separation. Write please, outlining experience and quoting No. 461, to—Box 7773, c/o Charles Barker & Sons Ltd., 31 Budge Row, London E.C.4. 3865

THE opportunity occurs for an electrical engineer, preferably between 35 and 50 years of age, experienced in installation work in buildings, and with sales contacts among architects and consultants, to participate in the management of an old-established electrical contracting company in London. Salary good; prospects better. Replies will be treated in strict confidence.—Box 3917.

THE advertisers, an old-established light electrical engineering firm, N.W. area, have immediate vacancies for draughtsmen (section leaders, seniors and juniors) who have experience in (a) chassis and rack design or (b) small electro-mechanical devices. All these posts are permanent and offer good prospects and attractive remuneration to those selected for appointment. Write, stating age, education, qualifications and experience, in confidence, to—Box 3721.

THE DISTILLERS Company Limited require for their Engineering Division, London office, senior and junior electrical draughtsmen for power and lighting layouts, with a knowledge of flameproof installation and equipment for industrial and chemical plants. Technical qualifications required are H.N.C. for senior and O.N.C. for junior draughtsmen. Replies giving full details of experience, qualifications, age and salary required should be addressed to—The Appointments Secretary, The Distillers Company Ltd., Engineering Division, Southern Office, Devonshire House, Mayfair Place, Piccadilly, London, W.1. 3765

TRANSFORMER test engineer. Young man required for a section of the test room dealing with a variety of unusual transformers. Preference will be given to applicants qualified by holding the O.N.C. in electrical engineering, completion of an apprenticeship with an electrical manufacturer, and having test experience on any types of transformers. Desirable additional experience would be testing precision instrument transformers, extra H.V. small transformers, transformers used by H.M. Services, and electrical instrument calibration. The salary would be determined by proof of experience and capabilities. Own staff have been informed.—Box 3603.

WANTED, first-class electricians with contracting experience preferably. Good opportunity and permanency for suitable men. Good prospects. Apply—Lee, Beesley & Co. Ltd., 6, Warwick Row, Coventry, or Lee, Beesley & Co. Ltd., 41, Snow Hill, Birmingham, 4. 3733

WESTINGHOUSE BRAKE & SIGNAL Co. Ltd. require electrical engineers with H.N.C. or degree for design of transformers, transductors and control circuits for selenium rectifier equipments handling milliwatts to megawatts. Interesting progressive posts offered in rectifier engineering dept. at Chippenham, Wiltshire. Apply to—Assistant Divisional Manager, Rectifiers, at London Office, 82, York Way, King's Cross, London, N.1. 3868

X-RAY service engineers are required by a large London company for service work throughout the country. Good salary and prospects for men with experience in this type of work. Applications, giving full details of age and experience, should be addressed to—Box ER.363, LPE., 110, St. Martin's Lane, London, W.C.2. 3892

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

E.W.F. Wholesaler, Leeds—Representative, S.E. Yorks. All applicants are thanked.

SITUATIONS WANTED

A GOOD all-round electrician. Technical education. Age 33 years. Car owner. Position with prospects.—120, Abbeville Road, London, S.W.4 (MACaulay 1645). 9976

DOMINION Govt. executive (A.M.I.Mech.E., A.M.I.E.E.) seeks U.K. post where comprehensive engineering and overseas experience useful. £1,500.—Box 9979.

ELECTRICAL contractor's engineer, fully experienced all classes of work, planning to final account, expert draughtsman, sixteen years last post, seeks senior or managerial position nr. Manchester area.—Box 9983.

ELECTRICIAN; prefer to travel. Seven yrs. last employer.—Box 9971.

PUBLIC school education, age 34, engineering and sales at home and abroad, experience in communications, requires senior position in London area.—Box 9984.

QUALIFIED elect./mech. engineer. Exp. management, technical, production, design on motors, etc., light engineering, control gear, gearing, foundry. Pres. sit. Essex/London.—Box 9975.

TECHNICAL representative desires position based at Brighton. Highest credentials. Waterheating and electro-agriculture speciality. —Box 9981.

WANTED, progressive post by representative, age 27. Area covering Yorkshire, W. Riding, preferred.—Box 9963.

FOR SALE

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Sale by Tender

THE MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD offer for sale the under-mentioned equipment:—

Item 1. Two Sets E.E. Rot. Convertors, 1,500 r.p.m., 250 kW, 460/500 v., D.C. Ltg. and 500/550-v. D.C. Traction, with 2 Transfrs. 275 kVA, 3/6 ph., 6,600 v., 50 c., complete with starting gear and D.C. switchboards.

Item 2. One Set B.T.H. Rot. Convertor, 1,000 r.p.m., 460/50 v. D.C., with M.V. Transf. 550 kVA, 3/6 ph., 6,600 v., 50 c., complete with starting gear and D.C. switchboard.

The above items are offered for sale individually or as a whole without guarantee as to their condition, and may be inspected at the Board's Depot at Willow Road, Wrexham, from 5th to the 16th July, 1954, inclusive.

Forms of tender, obtainable from the Manager, No. 4 Sub-Area, Merseyside and North Wales Electricity Board, Electricity House, Rhostyllen, Near Wrexham, must be forwarded through the post under cover of the label provided, so as to be received at Electricity House, aforesaid, not later than noon on Friday the 23rd July, 1954.

The Board do not bind themselves to accept the highest or any tender and reserve the right to accept any portion of a tender.

M. M. PARKER,
Secretary.

Electricity House,
Love Lane, Pall Mall,
Liverpool, 3.
June, 1954. 3893

SOUTH EASTERN ELECTRICITY BOARD

TENDERS are invited for scrap materials at Windsor Road Stores, Gillingham, Kent:—

Approx. 5 cwt. Bare Copper Strand.
,, 6 cwt. Mixed Brass and Copper.
,, 2 cwt. Lead.
,, 2 tons Underground Cable.

Inspection by arrangement with District Manager (Tel. Gillingham 5241).

Successful tenderer will be required to pay before collection. Tenders must be submitted in plain sealed envelope marked "Tender for Scrap Materials, Gillingham," and must reach the Secretary, SEEBoard, 10, Queen's Gardens, Hove, 3, Sussex, by 5.15 p.m. on 19th July, 1954.

The Board does not undertake to accept the highest or any tender.

A. L. BURNELL,
Secretary. 3835

3-PHASE TRANSFORMERS

kVA	Make.	Primary.	Sec.	Type.
750	BRYCE	11000	430	Indoor
500	E.C.C.	6600	415	Outdoor
500	BRUSH	3300	440	Indoor
400	HACKBRIDGE	3300	400	Indoor
300	E.C.C.	6600	415	Indoor
200	B.E.T.	15000	400	Outdoor
200	HACKBRIDGE	30000	400	Outdoor
125	HACKBRIDGE	6600	400	Indoor
110	G.E.C.	11000	400	Indoor
100	B.E.T.	22000	220	Outdoor
100	MET.-VICKERS	5500	400	Outdoor

GEORGE COHEN, SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 3833

B. C. S.

TWO 1,500-kW BRUSH Ljungstrom Turbo-Alternator Sets; working pressure 185 lb. per square inch; 6,600 volts, 3-phase, 50 cycles; 3,000 r.p.m.; complete with Surface Condenser and all ancillary equipment.

B.C.S. ENGINEERS & CONTRACTORS LTD.
3, Castle Street, Cardiff
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B. C. S.

Available for Immediate Delivery

TWO 600-kW SULZER Diesel Generating Sets, 440/220 volts D.C. Auxiliaries, spares, etc.

One 100-kW BLACKSTONE/CROMPTON PARKINSON, 400/440-3-50, 5-cylinder Vertical Engine, 500 r.p.m. All auxiliaries, etc.

Two 20-kW HILL & COMPANY/DELCO, 120 volts D.C., 167 amps., 1,450 r.p.m. Auxiliaries, etc.

Three 14-kW COVENTRY CLIMAX/McLURE & WHITFIELD, 230 volts D.C., 52 amps., 1,750 r.p.m. Auxiliaries, etc. Unused.

Other sets in stock.

B.C.S. ENGINEERS & CONTRACTORS LTD.
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MOTOR GENERATOR SETS

440-kW Set by E.C.C., 220 volts D.C., compound wound, driven from 650-r.p.m. synch. motor, 400/3/50, on bedplate, coupled at 600 r.p.m., with control gear.

250-kW Set by E.C.C., 460 volts D.C., compound wound, driven from 360-h.p. synch. motor, 400/3/50, on bedplate, coupled at 1,000 r.p.m., with control gear.

100-kW Set comprising 240-volt D.C. DELCO Generator driven from 150-h.p. BROOK Slip-ring Motor, 400/3/50, on underbed, coupled at 1,450 r.p.m., with control gear.

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Wood Lane, London, W.12
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ELECTRIC MOTORS

400/440 v., 3-phase, 50 cycles

1 15-h.p. B.T.H. Slipring, 960 r.p.m., complete with B.T.H. starter, secondhand, in very good condition, £40 or nearest offer.

2 20-h.p. BROOK Squirrel Cage, 1,420 r.p.m., complete with E.A.C. starters, new, £65 each or nearest offer.

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Engineers
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LONDON ELECTRICITY BOARD

OFFERS are invited for the purchase and removal of approximately 300 WOOD-FRAMED IRONCLAD SUNK TYPE FUSE-BOARDS (REVO), 2-8 way, 15 amp., and 50 IRONCLAD COMBINED SWITCH AND FUSE-BOARDS.

Full details and tender forms may be obtained on application to the Purchasing Officer, London Electricity Board, 46, New Broad Street, London, E.C.2, not later than 9th July, 1954. 3925

¼-h.p. MOTORS

120 off. B.T.H. 20/250 volts., 1,450 r.p.m., 1,425 r.p.m. Brand new. Also 25 off. ditto 400/3/50, reconditioned.

J. S. RAMSBOTTOM & CO. LTD.
Keighley. 57

PORTAWAY EARTH-CONTINUITY SYSTEM
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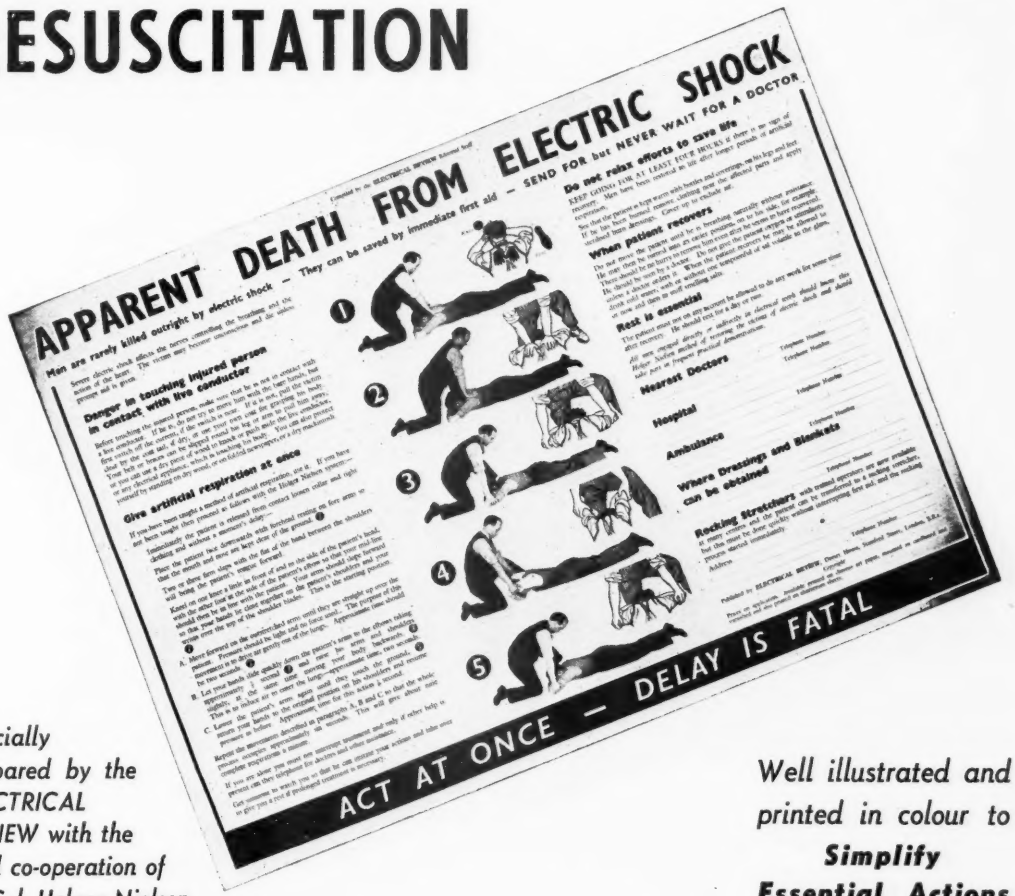
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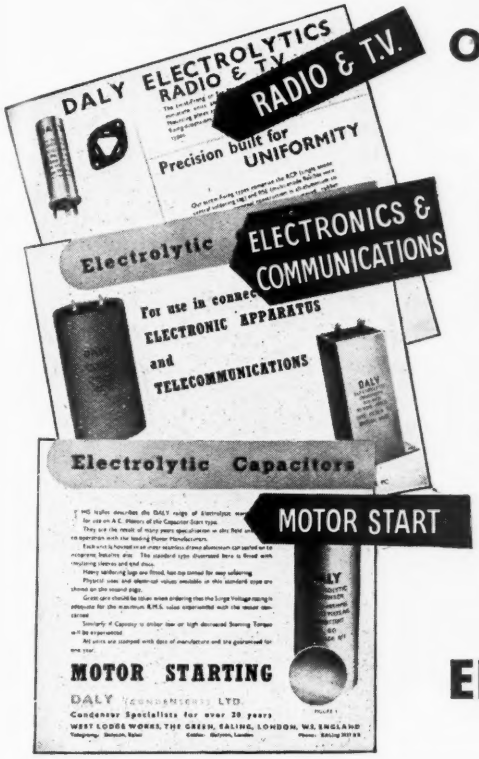

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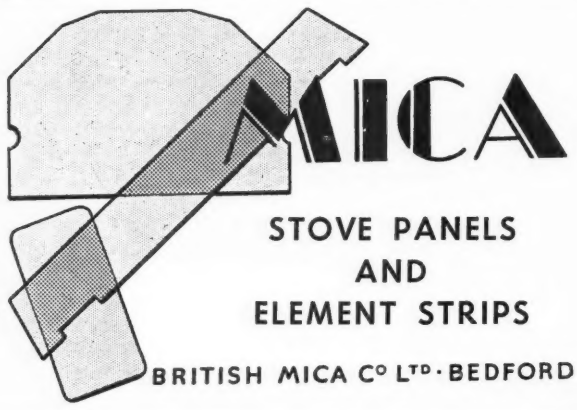

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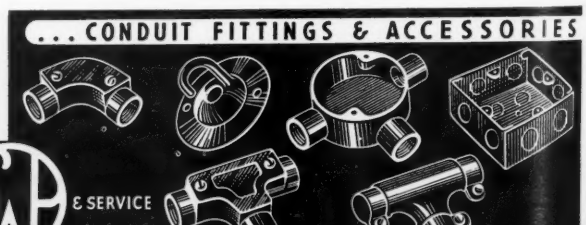

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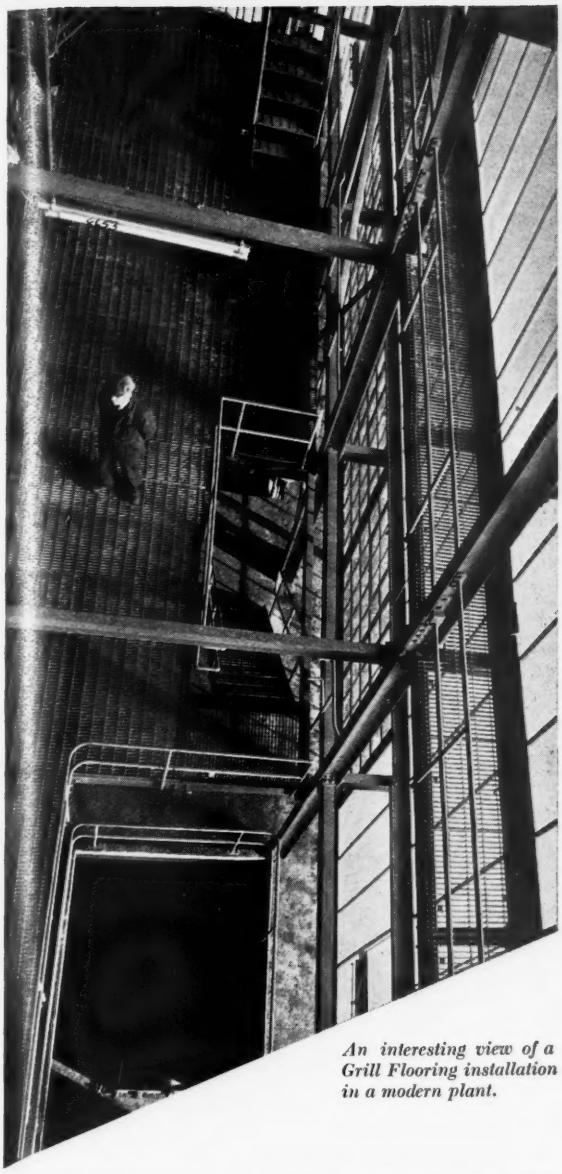

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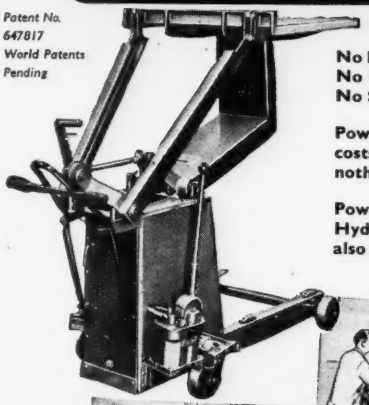

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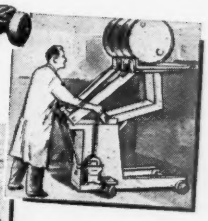

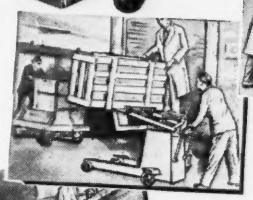

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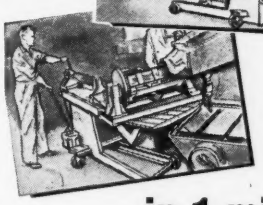

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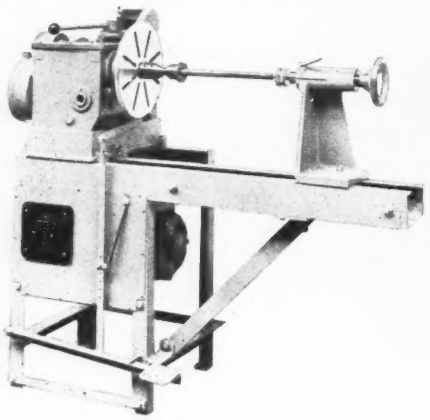

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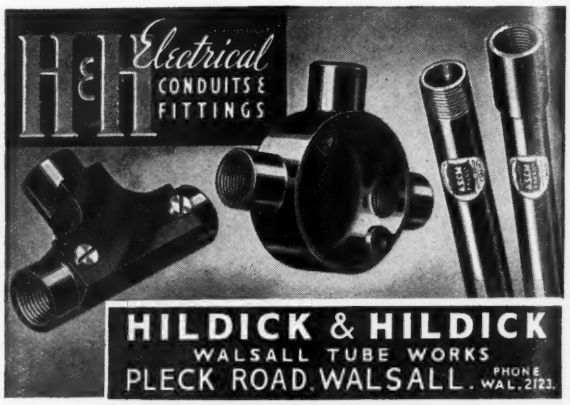

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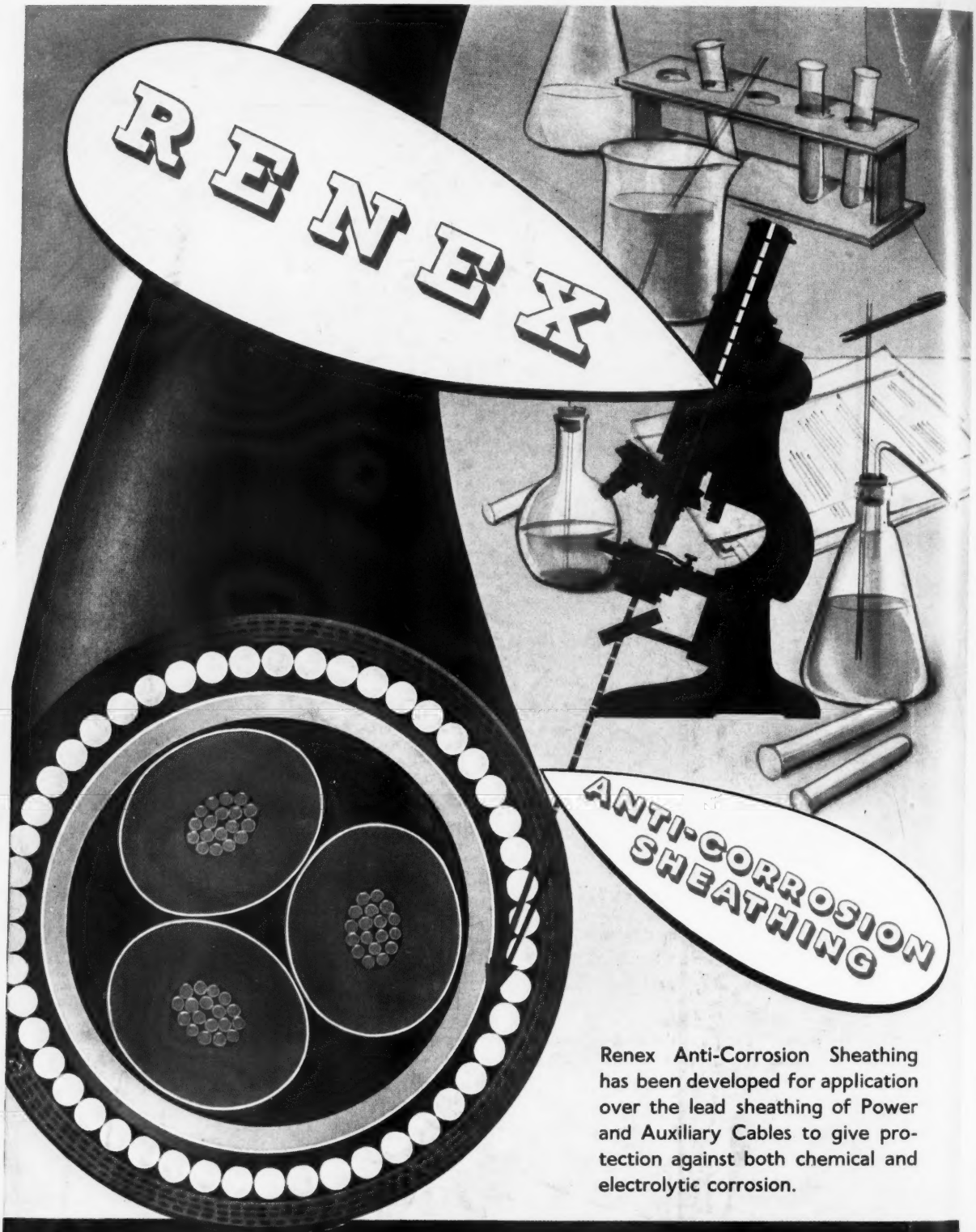

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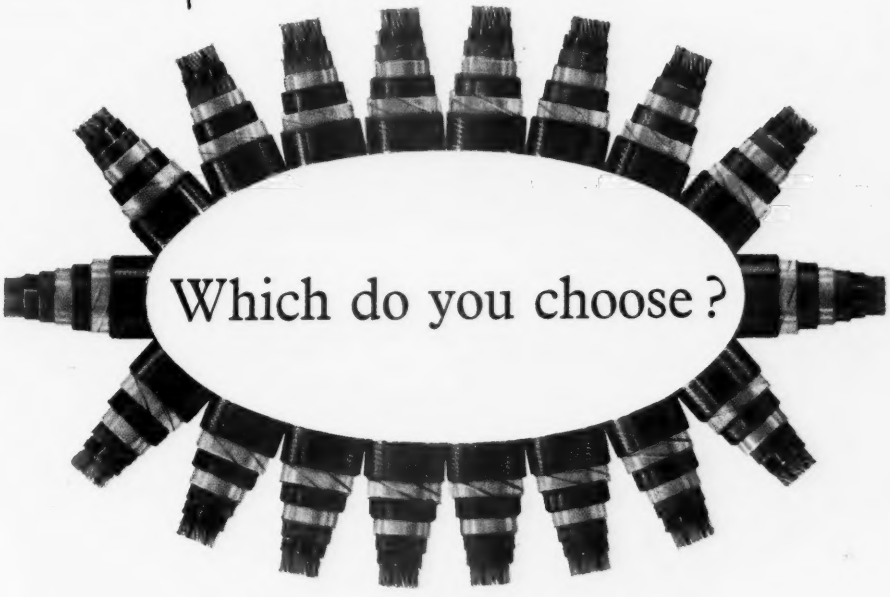

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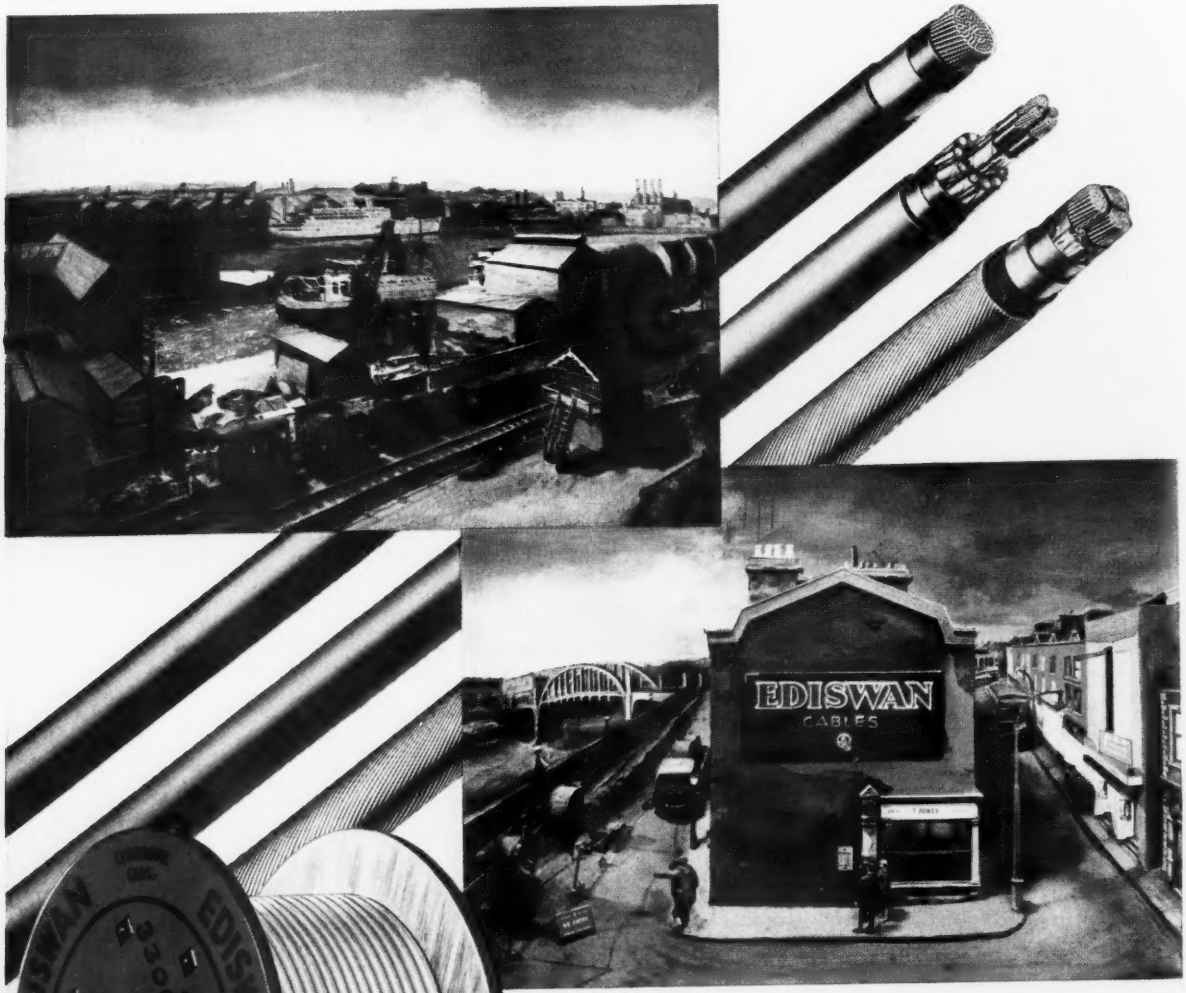

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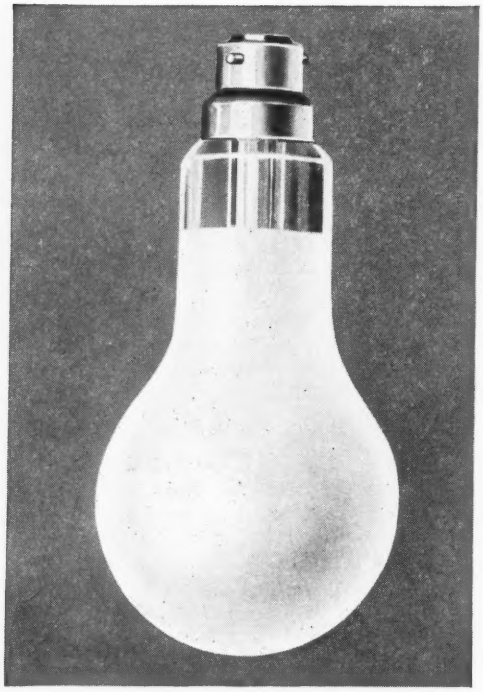

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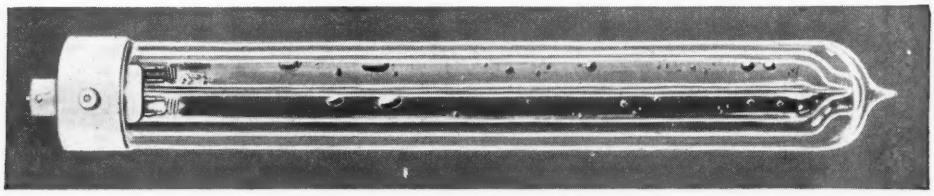

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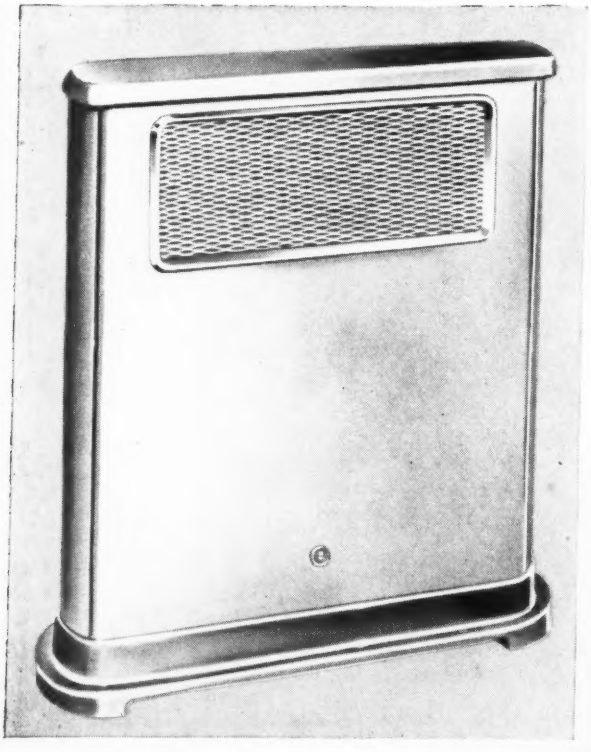

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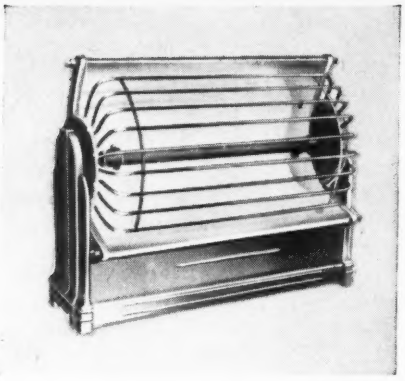
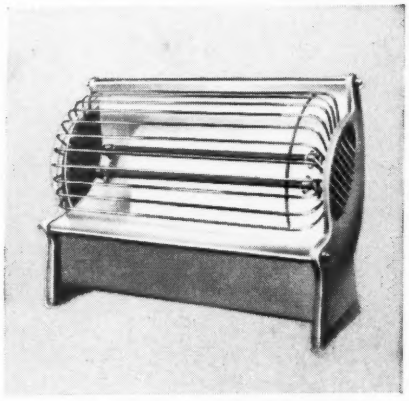


MEMRAY

Fine quality swivel reflector fire. Chromium plated brass reflector, efficient guard, robust cast construction. In 1 and 2 kW ratings.



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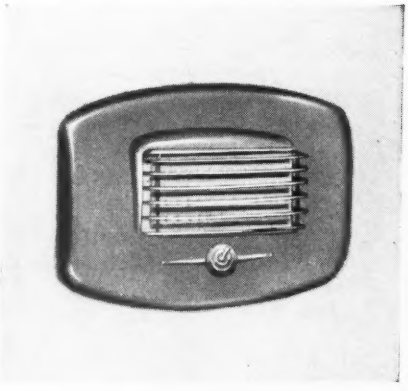
A sturdily built reflector fire offered at an attractive price. Cast iron sides, chromium plated brass reflector. In 1 and 2 kW ratings.



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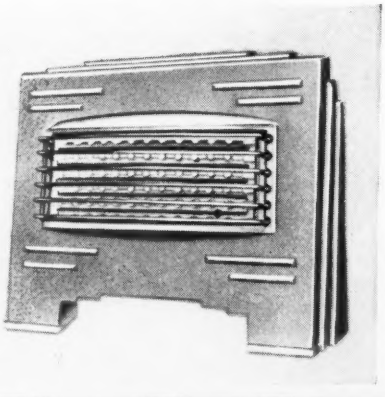

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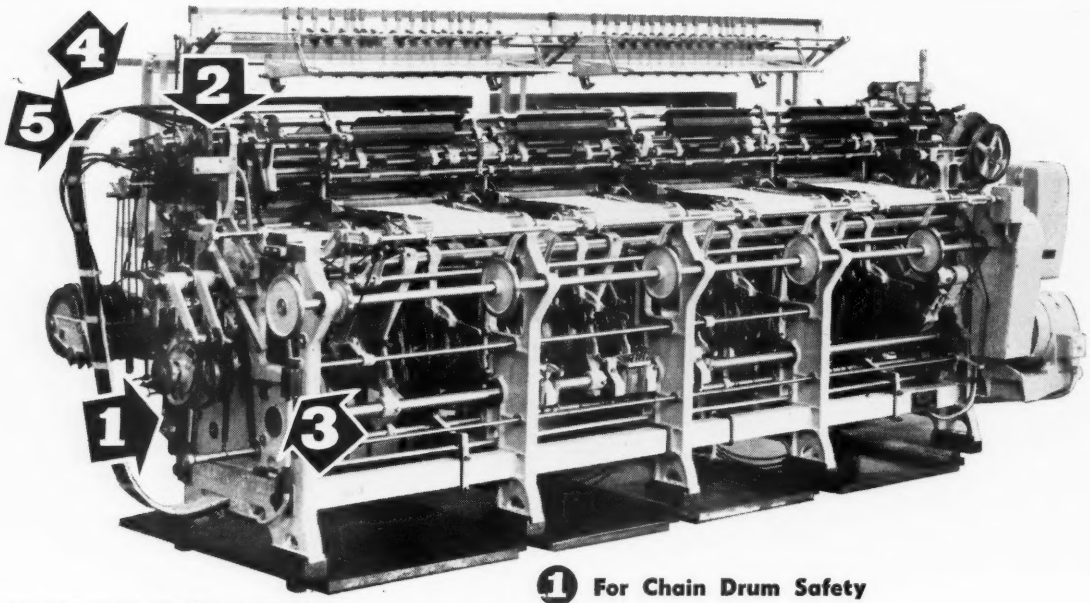

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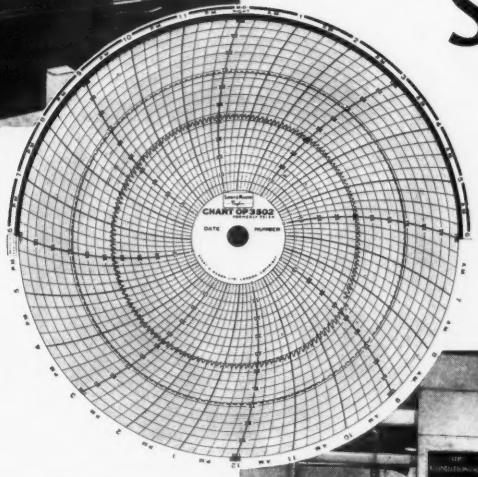
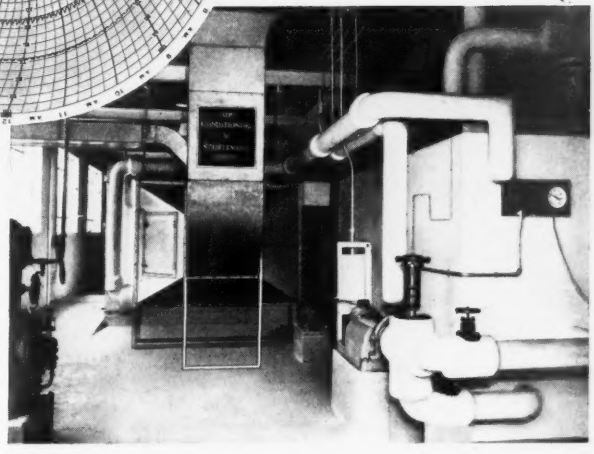


Constant Temperature Plant



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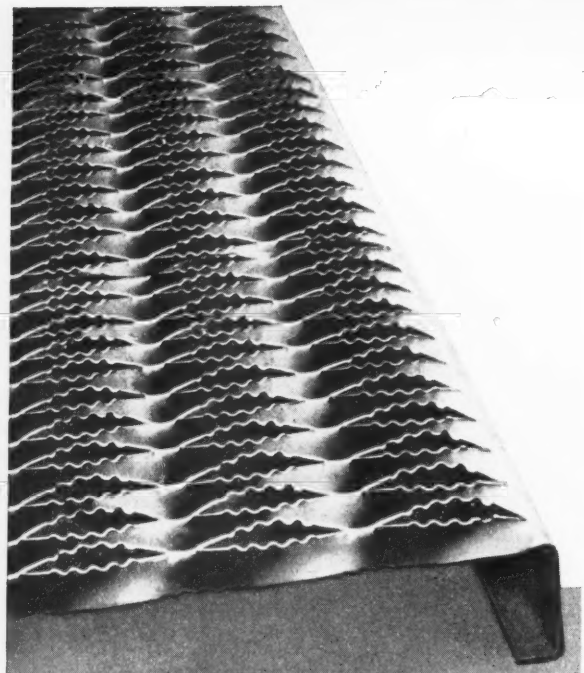

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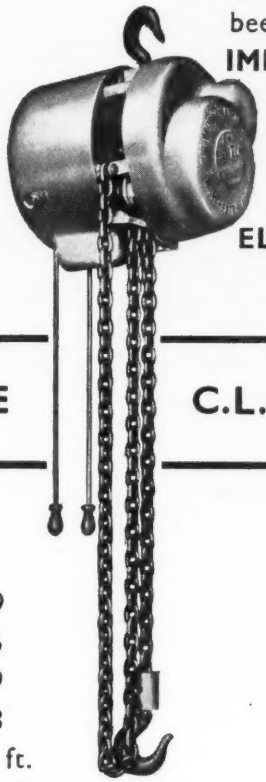

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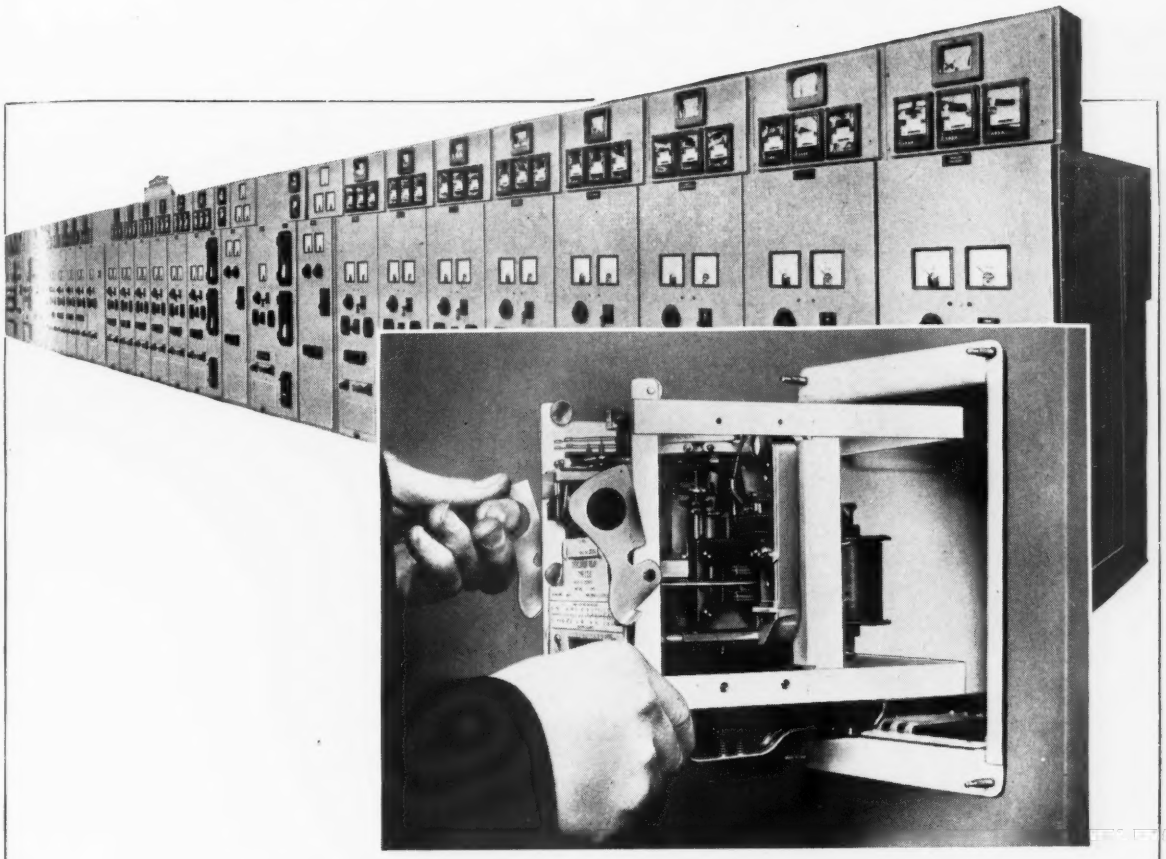

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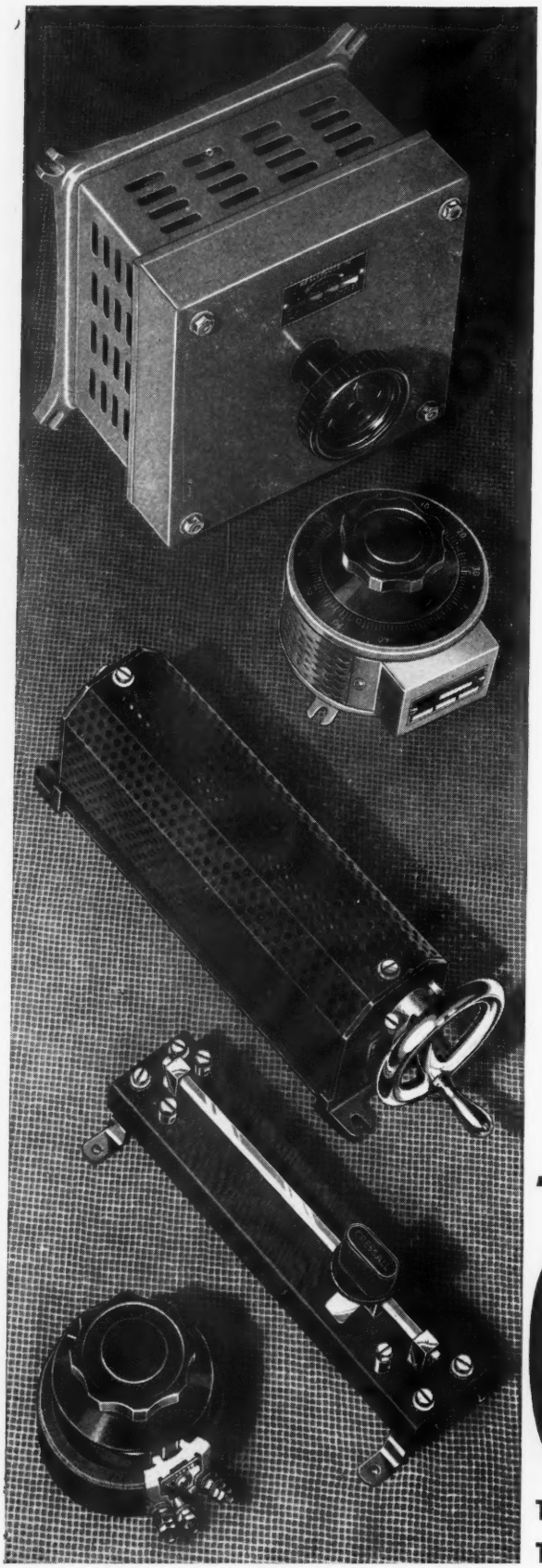

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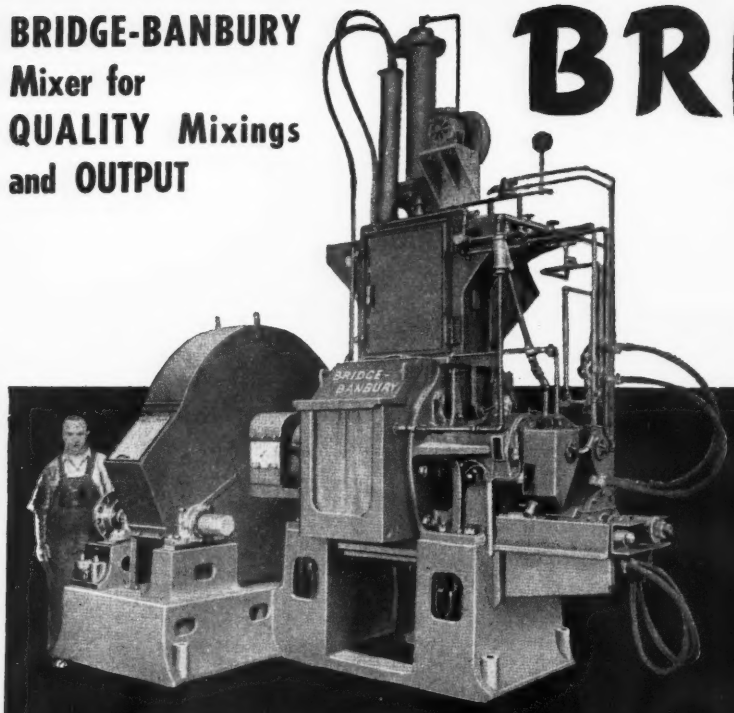

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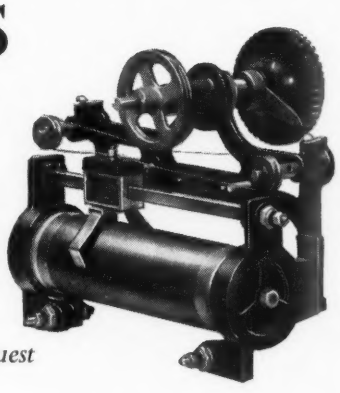

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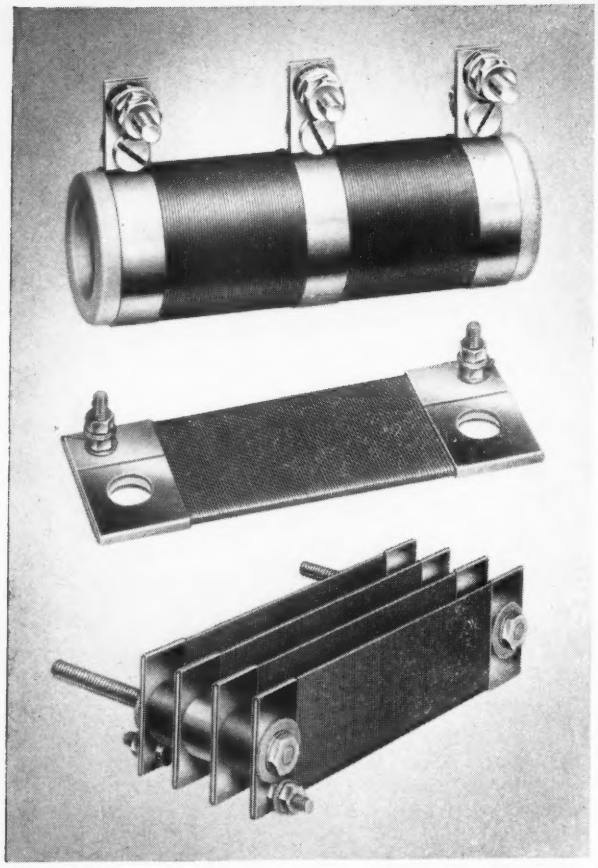

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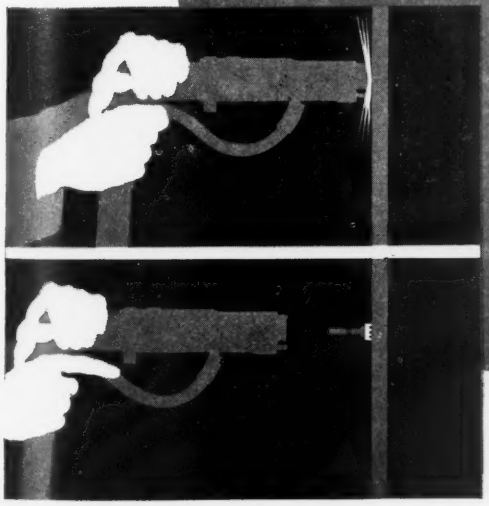

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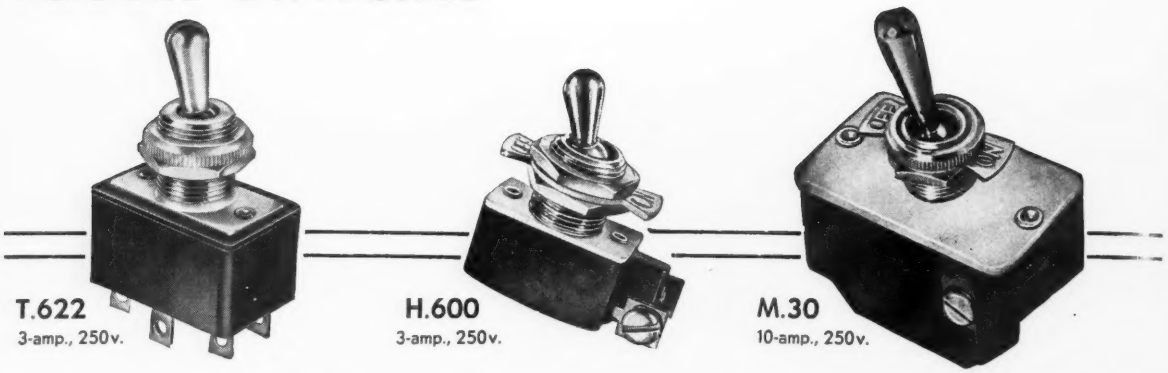

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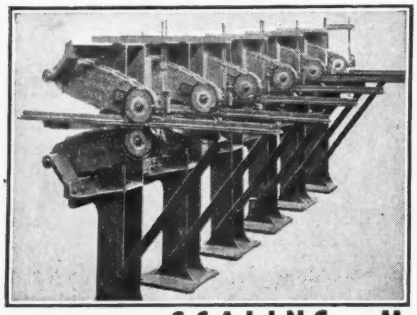

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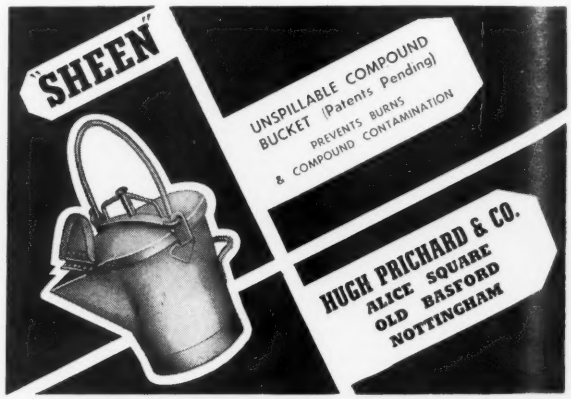

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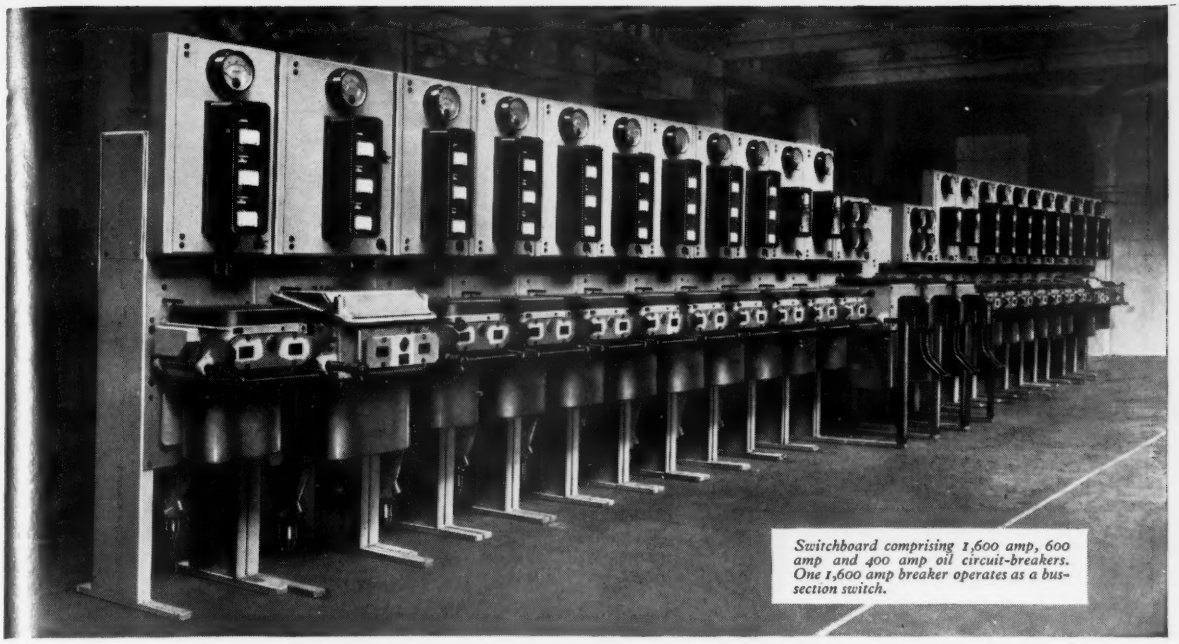

Switchboard comprising 1,600 amp, 600 amp and 400 amp oil circuit-breakers. One 1,600 amp breaker operates as a bus-section switch.

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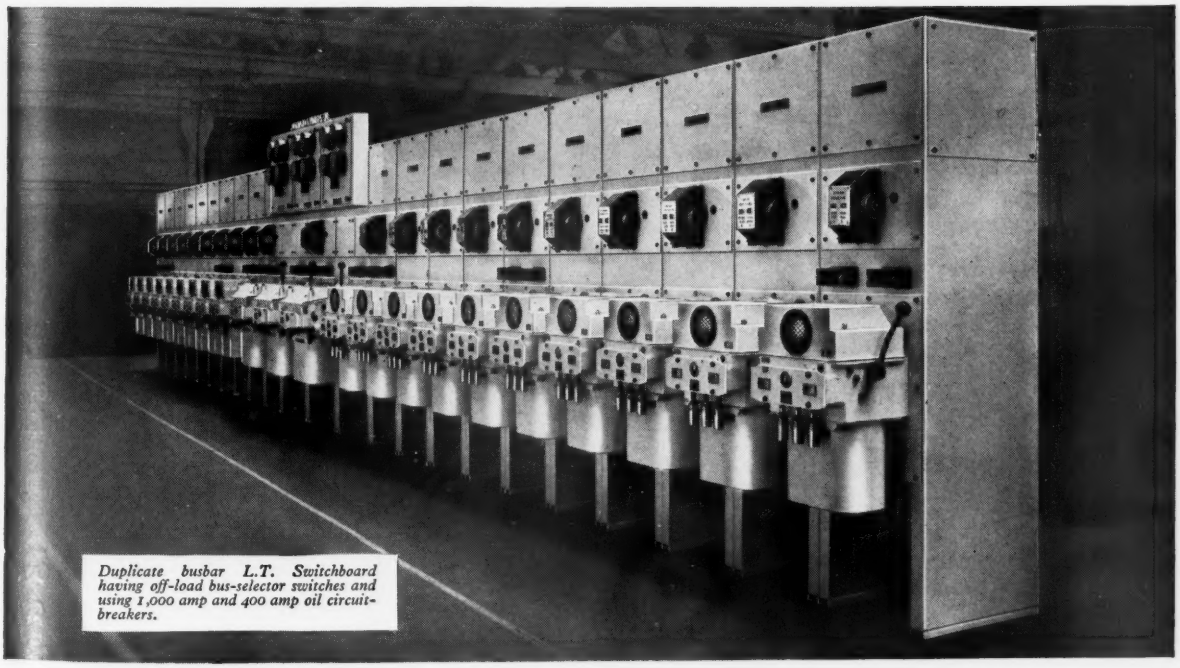

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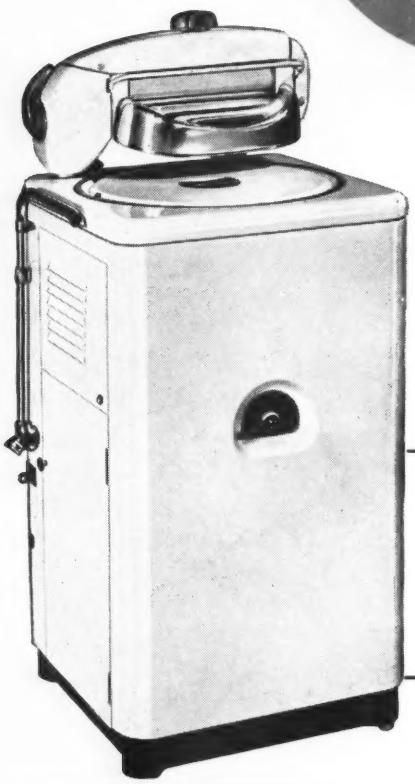

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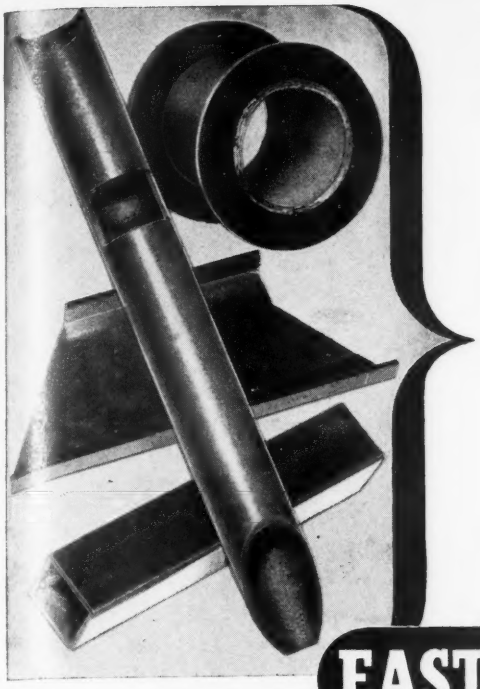

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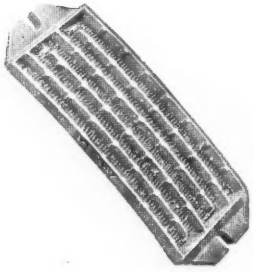

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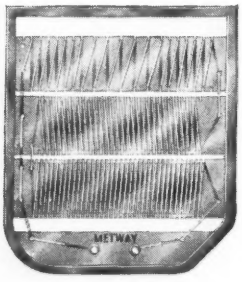

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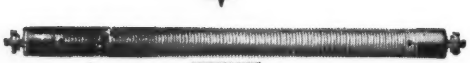

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Aluminium Alloy Ladders, Steps Electricians' Ladders, Trestles etc., for EVERY PURPOSE

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No more cussing from young George. No complaints from the chargehand. And no indignant 'phone calls from the Works Super, either! Getting Tru-Wel E.R.W. tubes has helped a lot. It's a tube you can trust, whether you buy it in straight lengths, or in manipulated components. Rigorous testing at every stage of manufacture ensures absolute uniformity in strength, lightness, concentricity and composition from the first Tru-Wel tube to the last.

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Supplied in straight lengths from $\frac{1}{8}$" o/d to $4\frac{1}{2}$" o/d in gauges 22 to 6, or manipulated to your special requirements. Also available in a range of standard sections.

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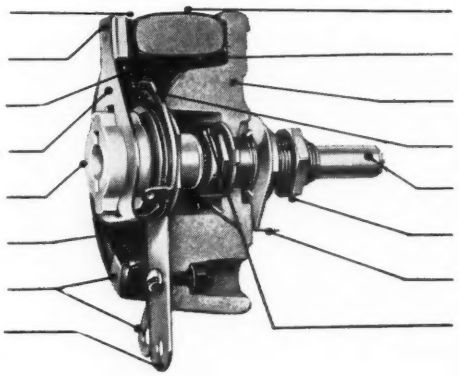

1 Silver graphite brush contact
2 Balance point for self-aligning brush
3 Pig tail shunting brush arm
4 Nickel silver brush arm
5 Glazed porcelain brush arm insulator
6 Winding welded to terminal band
7 End contact band and terminal
8 Brush terminal
9 Winding embedded in vitreous enamel
10 Vitreous enamel bond between former and base
11 All ceramic construction withstands 5000v. flash test
12 Non-grooving return contact piece
13 Stainless steel spindle available in wide range of lengths
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15 Panel locating washer to prevent rotation of assembly
16 Stop on shaft engages pressing in base moulding groove.

...BERCO TOROIDAL RHEOSTATS

All units arranged for panel mounting—protected type units available for either back or front of board mounting—two or more units can be ganged together for special networks and where space is limited. For full technical details and prices ask for List 613A.

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BERCO

BRITISH-AM

which one of these gravity die casting advantages helps YOU most?

Brass, Bronze and Aluminium Gravity Die Casting can show a real saving. Here are nine reasons:—

1 It eliminates or reduces the number of machining operations and consequently the weight of metal.

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3 The dimensional accuracy obtained simplifies jigging.

4 It ensures a constant flow of dimensionally accurate components at any desired rate.

5 Die casting cuts finishing costs.

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THE NON-FERROUS DIE CASTING Co. Ltd.

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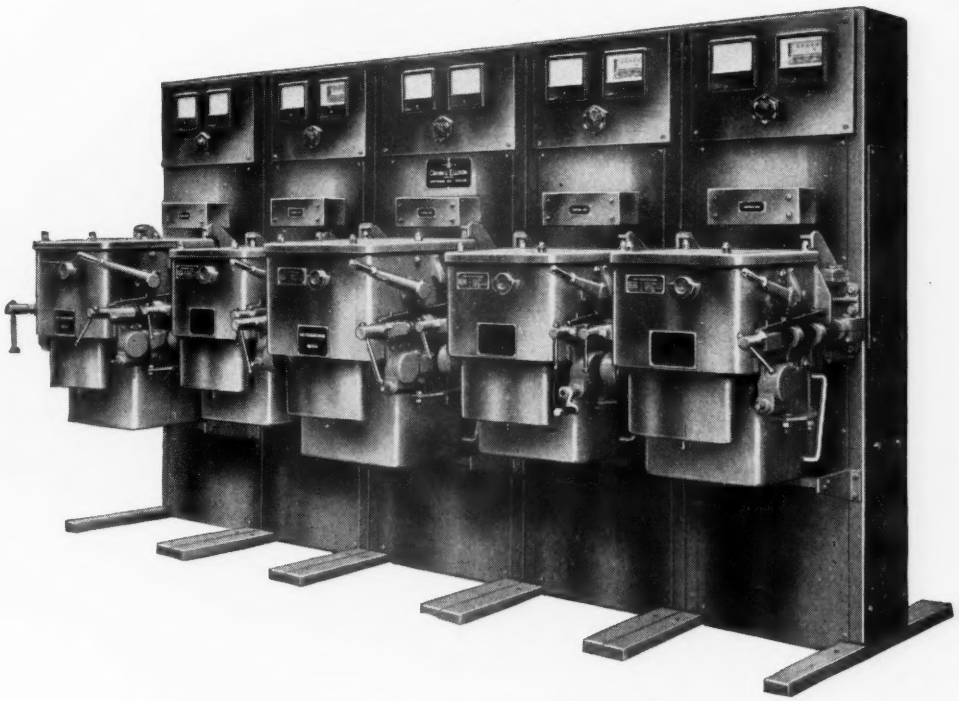
A.S.T.A. TESTED SWITCHGEAR

Complying with B.S. 116: 1952



"ELLISON" 660 VOLT DISTRIBUTION SWITCHBOARDS are available with tested circuit breakers in current rating sizes of up to 2400 amps and 45 M.V.A. rated breaking capacity. They are designed for easy and safe maintenance and flush mounted instruments add to the clean appearance.

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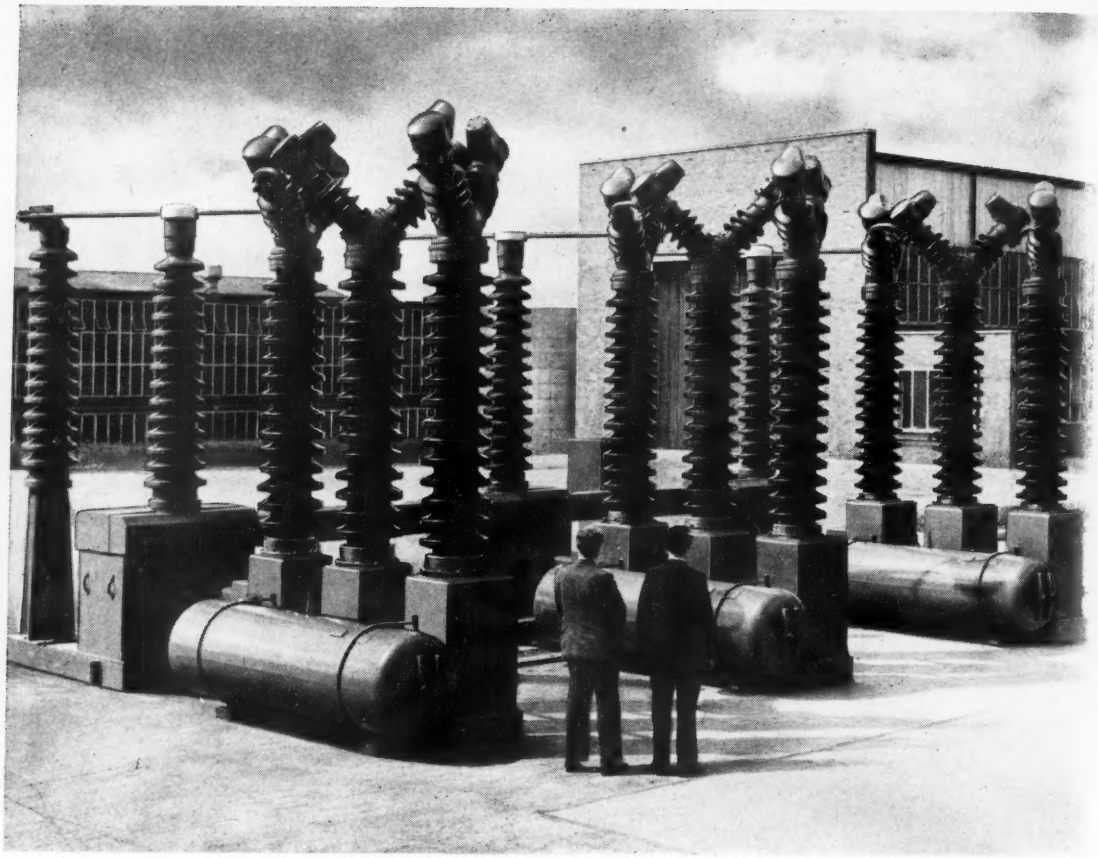

275-kV 7500-MVA air-blast circuit-breaker for the B.E.A. super-grid system.

Air-blast or

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is available for all

extra-high voltages

up to 275 kV

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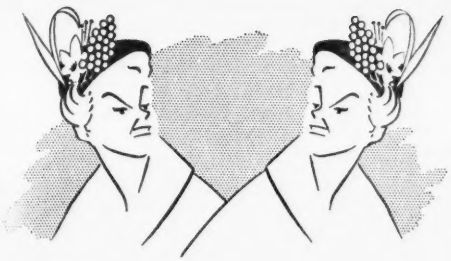

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bright steel bars

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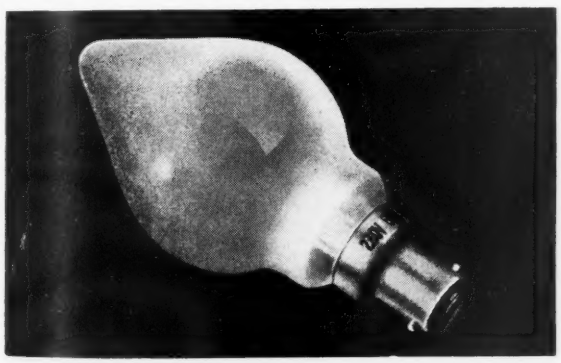

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BAYONET OR SCREW CAP

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Electric
SOLDERGUNS AND SOLDERING IRONS

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Unbeatable from every point of view, well able to withstand hard workshop treatment and ideal for continuous use. Features include rapid constant localised heat—solid sturdy construction—low current consumption—perfect balance—absolute dependability. A type and bit for every purpose from fine instrument to heavy industrial work.
Each tool includes 5 feet tough rubber 3-core cable.

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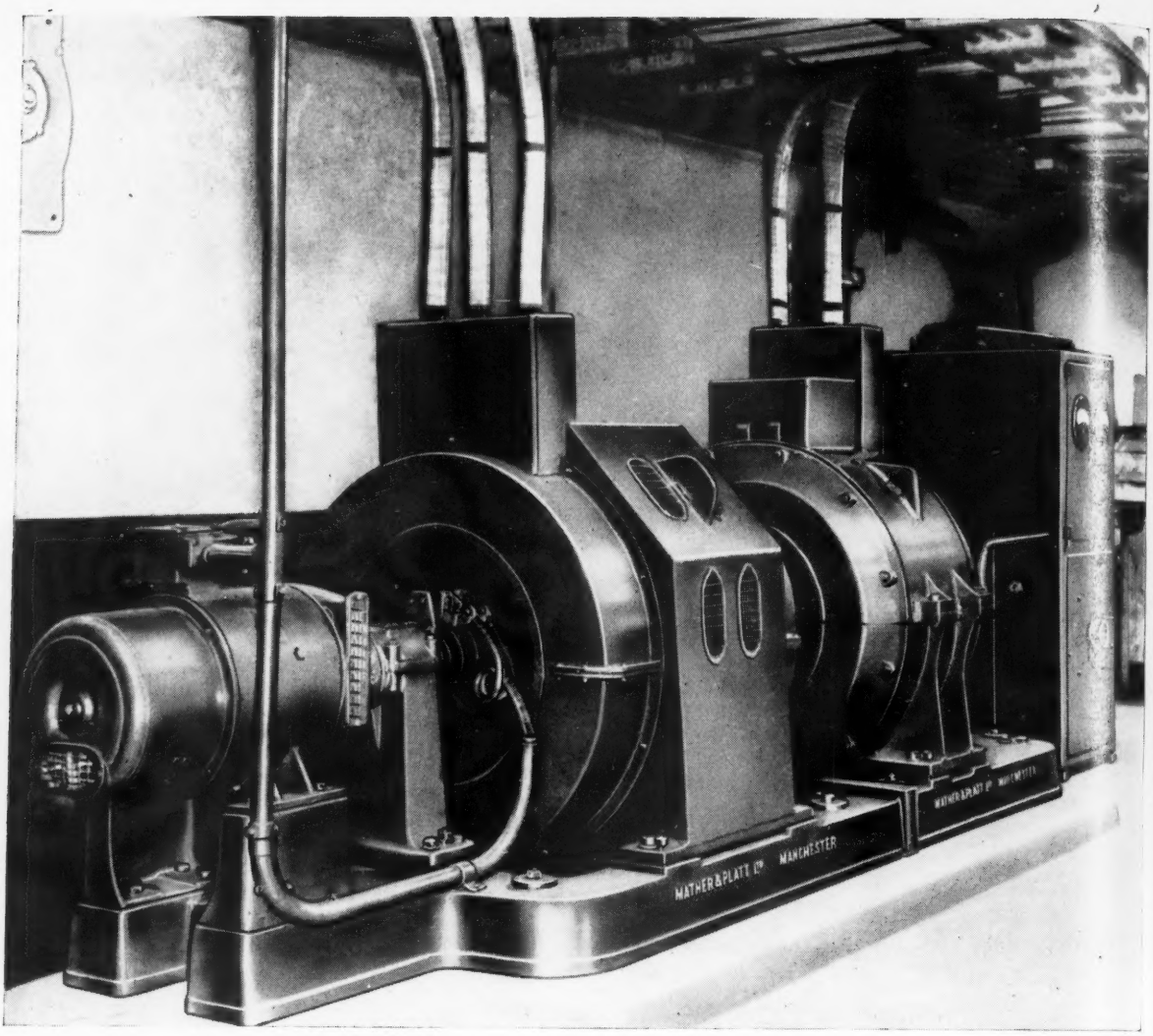


438

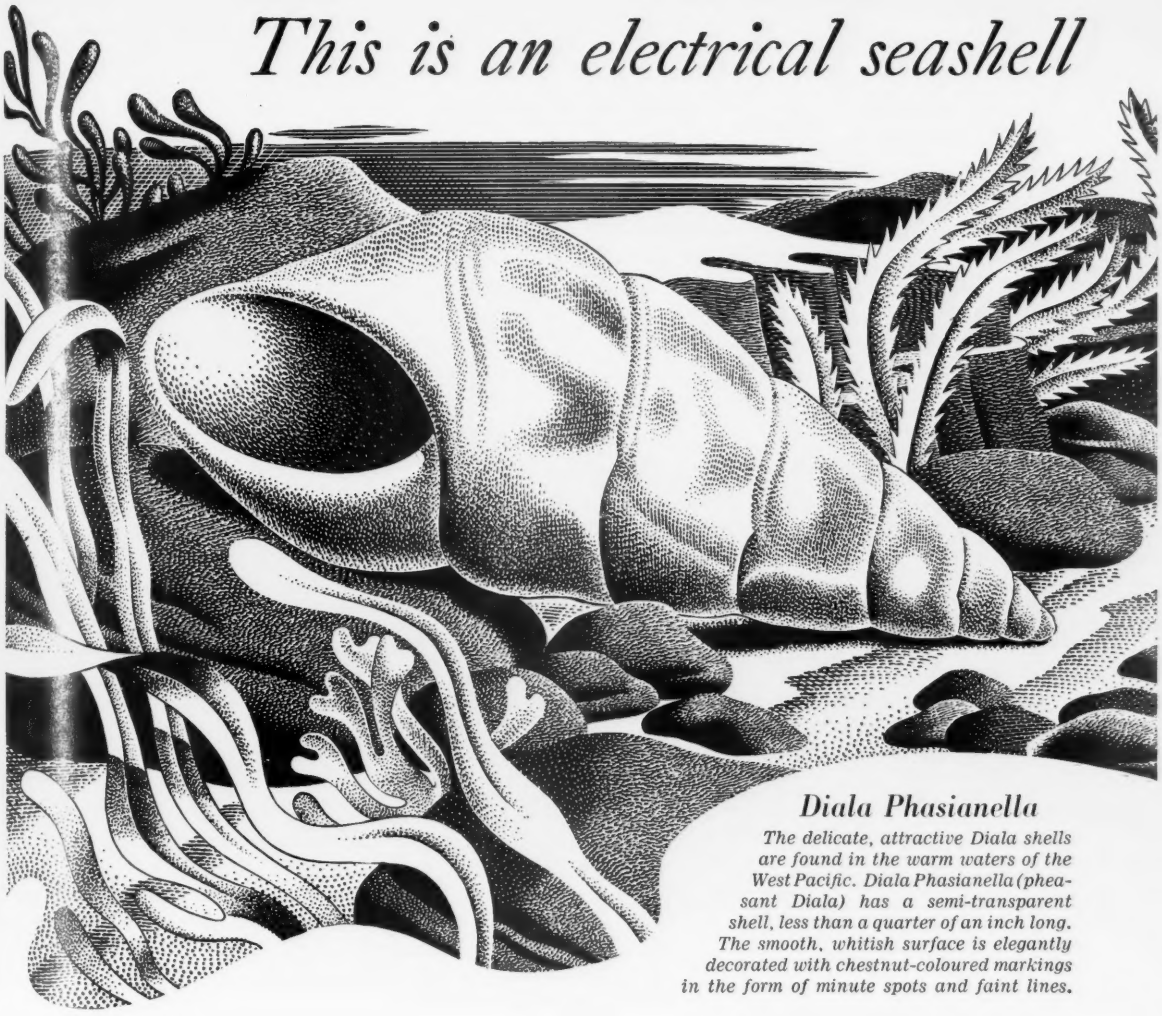
POWER *for industry*

The motor generator set illustrated is installed at a South of England paper mill. The motor is a direct-on started 435 h.p. synchronous machine, 400 v., 0·5 leading power factor, 1,000 r.p.m., starting current 2½ times full load current. The D.C. generator supplies 300 kW at 230 v.

MOTOR GENERATOR SETS

MATHER & PLATT LTD PARK WORKS · MANCHESTER 10

This is an electrical seashell



Diala Phasianella

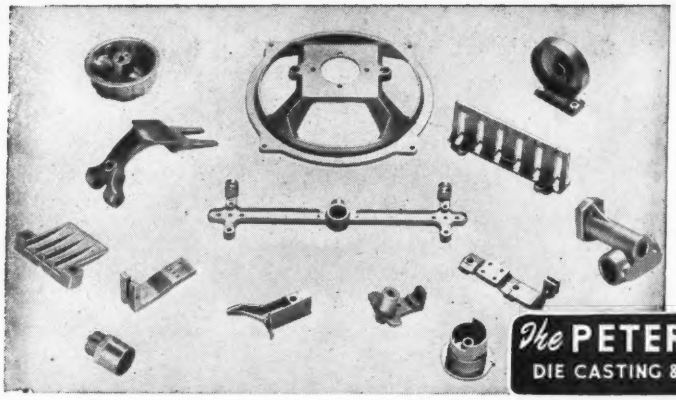
The delicate, attractive Diala shells are found in the warm waters of the West Pacific. Diala Phasianella (pheasant Diala) has a semi-transparent shell, less than a quarter of an inch long. The smooth, whitish surface is elegantly decorated with chestnut-coloured markings in the form of minute spots and faint lines.

Shell Diala Oils are specially designed for transformers, oil-filled switchgear and capacitors, and for general insulating and dielectric purposes. Shell Diala Oil B complies with British Standard Specification 148/1951.

Shell Diala Oils

SHELL

LEADERSHIP IN LUBRICATION



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in aluminium and zinc alloys for the Electrical and Allied trades to **correct metallurgical standards.**

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If your needs are for exacting accuracy, quality and quantity we have continuous experience of over a QUARTER CENTURY.

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V.I.R. Taped and Braided: Tough Rubber; Lead Covered and Flexibles

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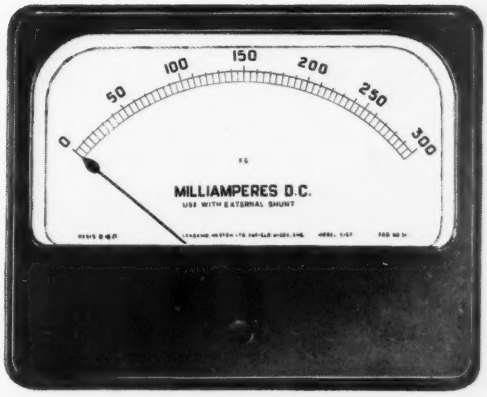
Telephone: BATtersea 2273 (5 lines) *Telegrams: "Wandleside, London"* *London Office: 30 Tottenham St., W.1*

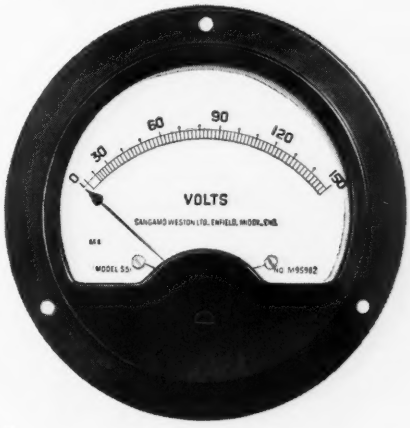
WESTON panel instruments



Both round and rectangular models of moving iron, moving coil, A.C. rectifier and H.F. thermocouple types are offered. In the range of rectangular instruments, which have been introduced to give the advantage of long, easily-read scales and to harmonize with rectangular panels, certain models are available with illuminated dials. Full particulars of types and ranges available are to be found in leaflets List Nos. W.1 and W.2, copies of which are available on request.

Rectangular panel instruments are available with scale lengths of 2·5″, 3·2″, and 4·2″.

These offer the advantage of an increase in scale length of approximately 50% over their equivalent round models, for which they can be used as direct replacements using the same panel fixing holes.



Round models are housed in cases of 2″, 2½″ and 3½″ diameter and have scale lengths of 1·7″, 2·1″ and 2·8″ respectively.

Larger instruments, both round and rectangular and for switchboard or panel mounting, are also available. These have scale lengths of 6″ and 6¼″ respectively.

SANGAMO WESTON LIMITED

Enfield, Middlesex · Tel: ENField 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

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TO BRITISH STANDARD SPECIFICATIONS 816 AND 546

Volex

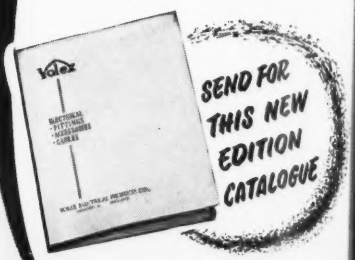
5 and 15 amp. PLUGS, SOCKETS and SWITCH SOCKETS
5 amp. 1-and 2-Way TUMBLER SWITCHES

★ SUPERIOR QUALITY

★ UTMOST RELIABILITY

★ SUPERLATIVE DESIGN AND FINISH

The range of "Volex" 5 and 15 amp. Plug Sockets with and without switch, embodies many features which provide maximum safety and efficiency under the most stringent operational conditions.



Volex VOLEX ELECTRICAL PRODUCTS LTD
SALFORD 6

Telephone: PENdleton 4373 Telegrams: "VOLEXPROD", Salford 6

FAIR PLAY

SWITCH BLOCKS

built of* KILN DRIED *timber

STAY FLAT

AND CORRECT SHAPE

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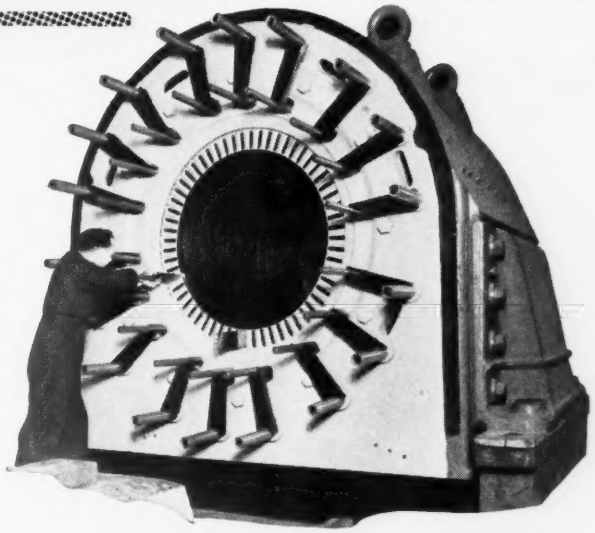
ALMA WORKS, PONDERS END
MIDDLESEX
TELEPHONE: HOWARD 1858

Urgent or intricate —or both?

However urgent, intricate or big the job, if it's a question of electrical repairs, contact your nearest B.E.R.L. works. Above is shown a typical job—a complete rewind on a 16,500 kVA Alternator. The first new stator bar is just being inserted and the lower view shows this stage completed.

Write to us now for the addresses, telephone numbers and names of our branch managers, any of whom will give you immediate and personal attention.



14 Service Works—Telephone the District Manager

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BRITISH ELECTRICAL REPAIRS LIMITED
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Works Service at: **BATH, BIRMINGHAM, CARDIFF, CHESTERFIELD, EDINBURGH, GLASGOW, HAWICK, LONDON, MANCHESTER, NEWCASTLE, SWANSEA**

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BEDS

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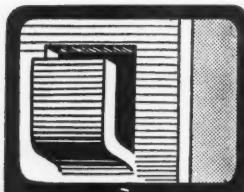
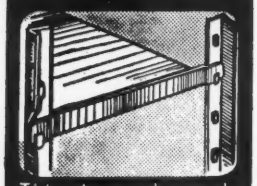
Associated with Weekes of (Luton) Ltd.



This shows the special pressed support, punched every 3" in the uprights.



This shows the angle runner in position, giving a definite and secure lock.

Finger tip control for the shelves. Easily adjustable. Self locking.

SCREWLESS
ADJUSTABLE SHELVING !

(Patent Application No. 23636/52)

SIMPLY PERFECT
and
PERFECTLY SIMPLE

- **SOLVE YOUR STORAGE PROBLEMS WITH AUSWAL SHELVING.**
- **MEETS ALL YOUR REQUIREMENTS DUE TO ITS AMAZING ADAPTABILITY.**
- **FINISHED IN THE NEW GREY-BLUE. SEND FOR CATALOGUE. FILL IN THIS SLIP.**

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AYRES ROAD, OLD TRAFFORD MANCHESTER · 16
GRAMS: "OHMIC 16" PHONE: TRAFFORD PARK 1827 (2 lines)

Please send your Catalogue to : E.R.2

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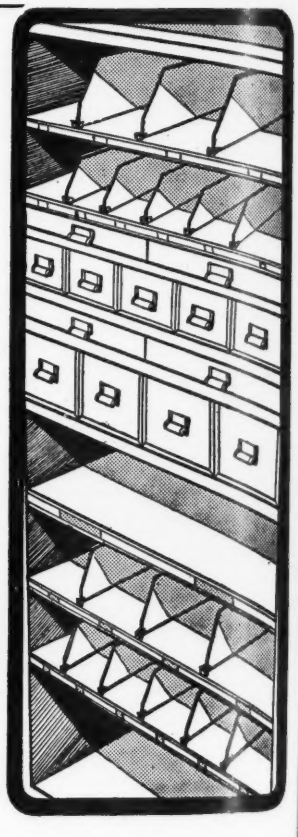

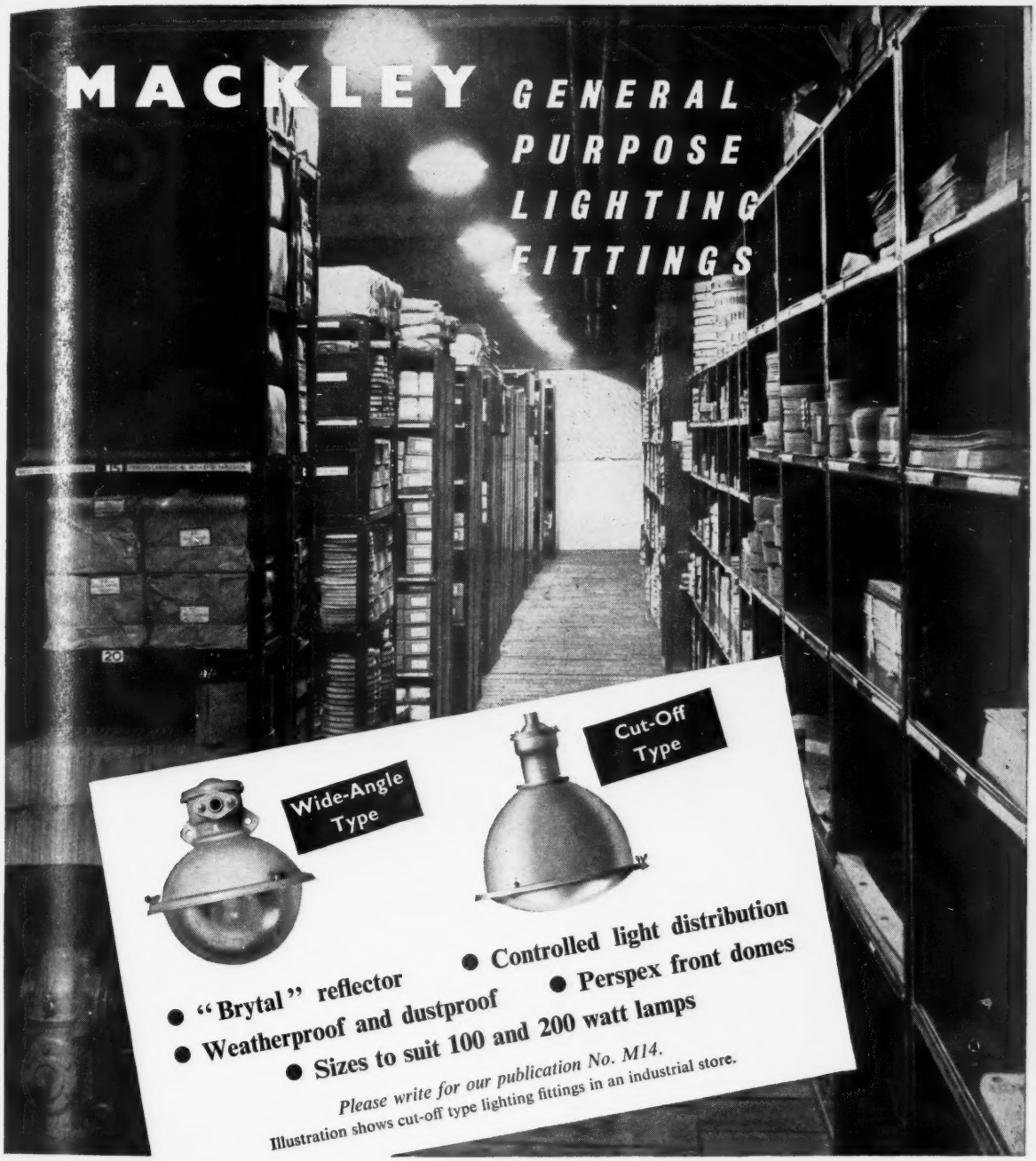

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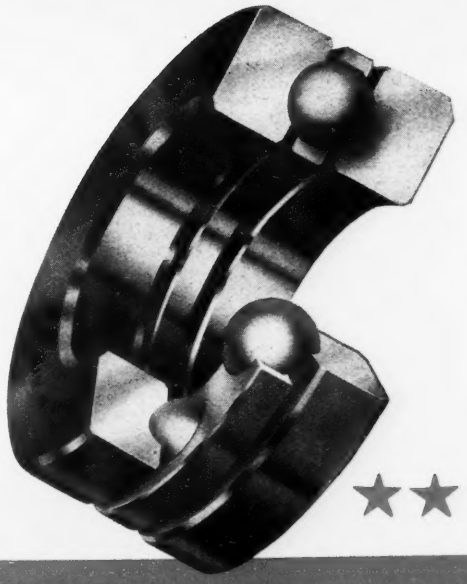
No. A.7

Specify—

BALL & ROLLER R&M BEARINGS



They save in the long run

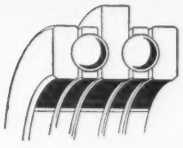
THERE IS A BEARING FOR EVERY INDUSTRY'S NEED

- ★★ THRUST BEARINGS
- ★ BALL JOURNALS
- ★ ROLLER JOURNALS
- ★ DOUBLE PURPOSE BEARINGS
- ★ LINESHAFT BEARINGS
- ★ NEEDLE ROLLER BEARINGS
- ★ AIRCRAFT BEARINGS

OUR ENGINEERING DEPARTMENT WILL WELCOME THE OPPORTUNITY TO CONSIDER YOUR SPECIFIC APPLICATIONS AND MAKE RECOMMENDATIONS.

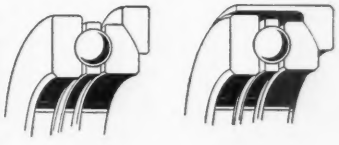
THRUST BEARINGS

In this series the balls run between washers in which suitable tracks are formed. The single row type shown above will only resist thrust in one direction.

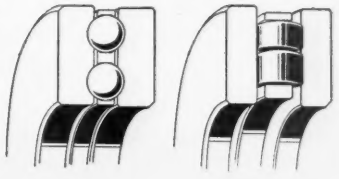


Where thrust loads are in alternate directions, Double Thrust Bearings are available.

Should the bearings be required to allow for misalignment, the washers are ground spherical and fit in a spherical seating formed either on an additional washer or in a housing.



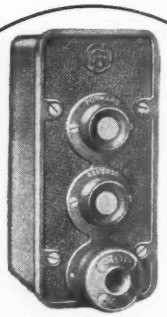
Where loads are exceptionally heavy, thrust bearings with two rows of balls, or multiple rows of rollers, can be made to specific requirements.



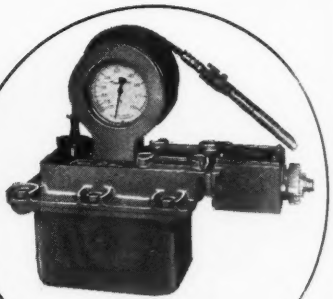
RANSOME & MARLES BEARING CO., LTD., NEWARK-ON-TRENT, ENGLAND

K/RM 115

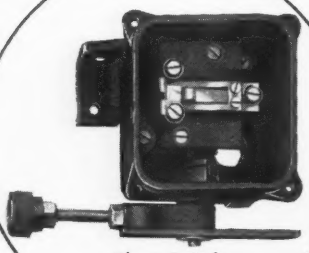
EAC STARTERS and Accessories



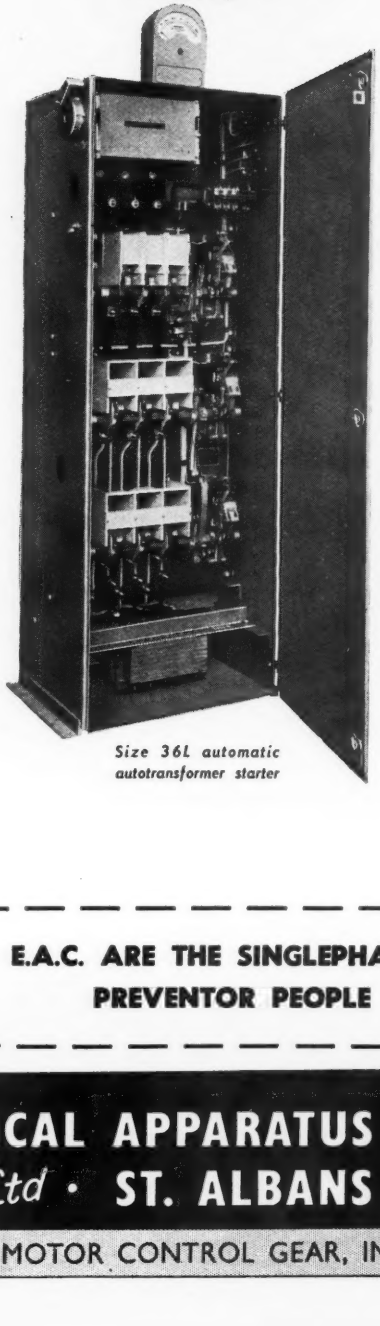
Heavy duty 3-way Push Button Station



Flameproof Thermostat



Float Switch (Light Pattern)



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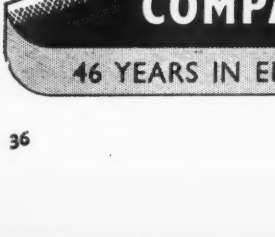

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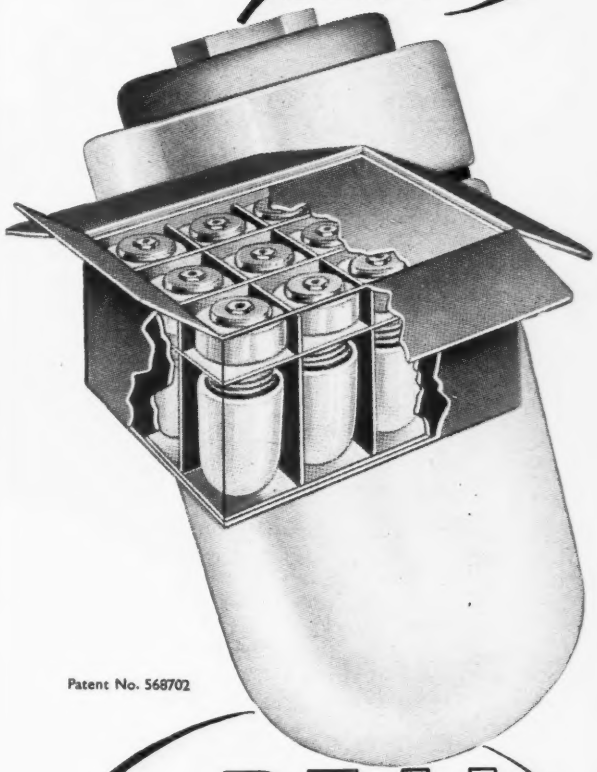

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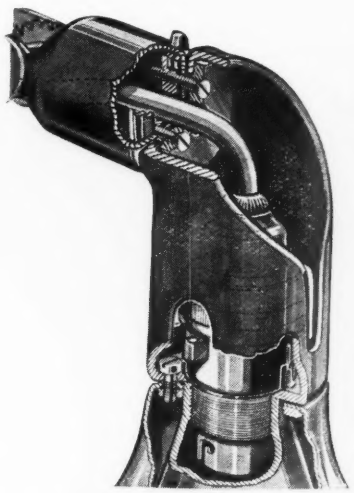

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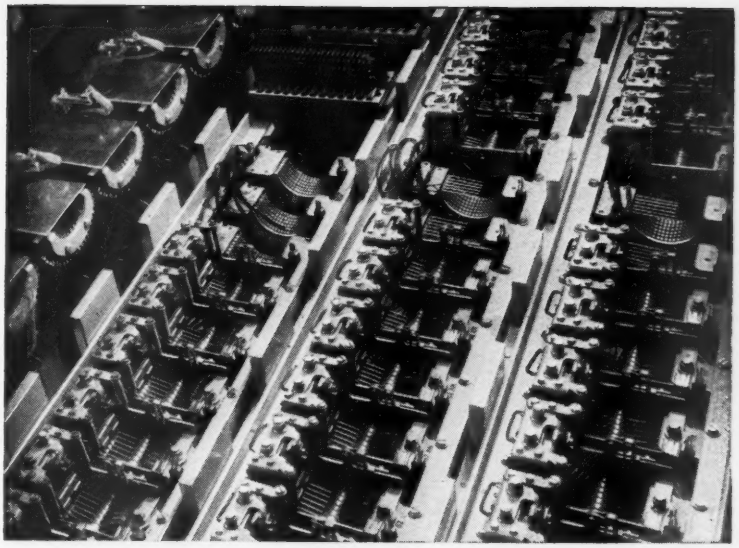

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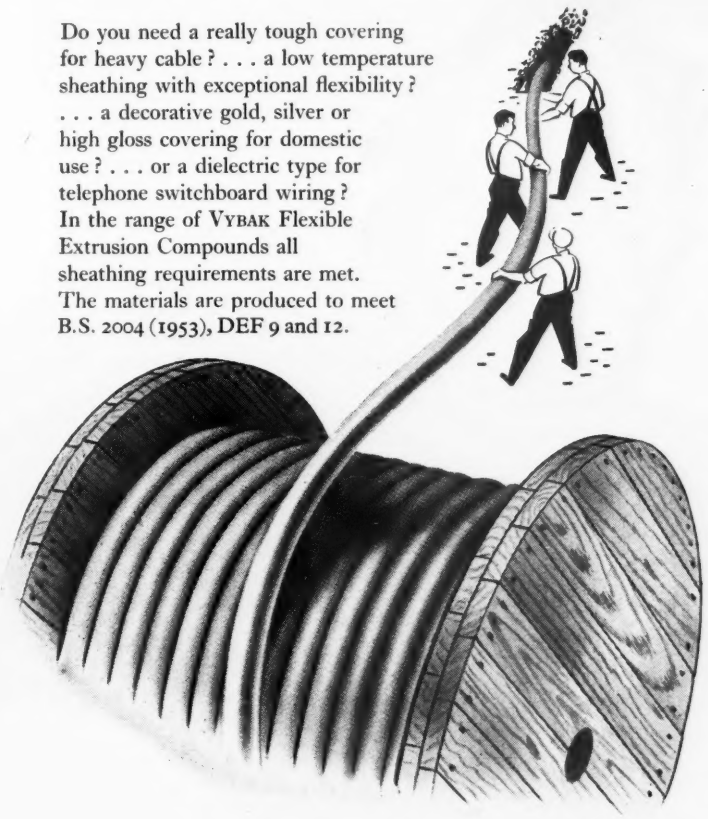

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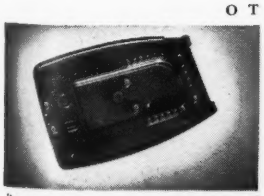
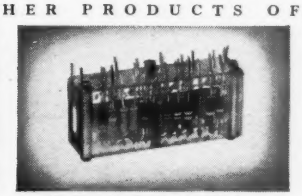
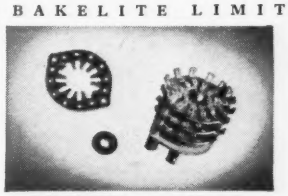


Telephone receiver case in BAKELITE rubber-modified polystyrene material



Radio circuit "potted" in BAKELITE Polyester Resin



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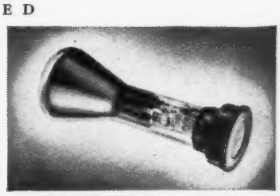

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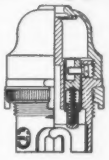

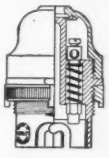

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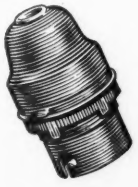
Terminals move during lamp insertion or removal.



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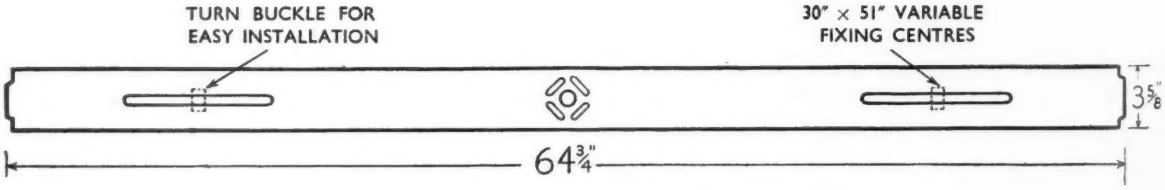

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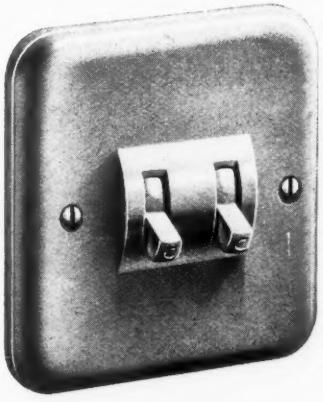

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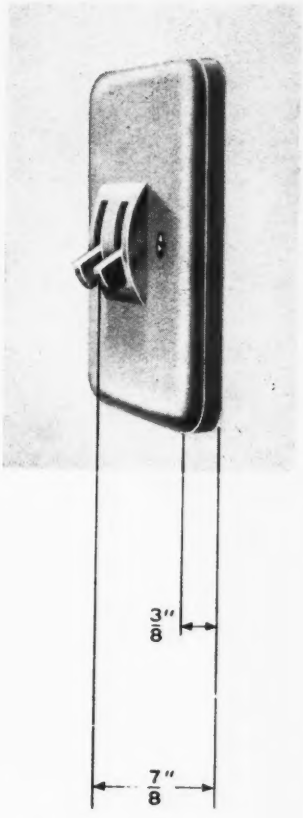

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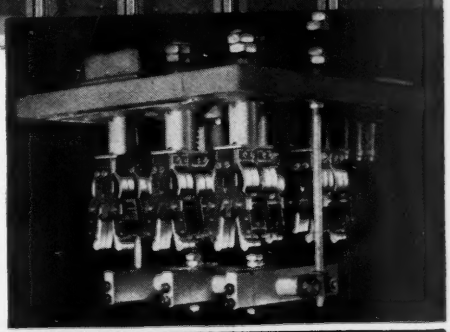

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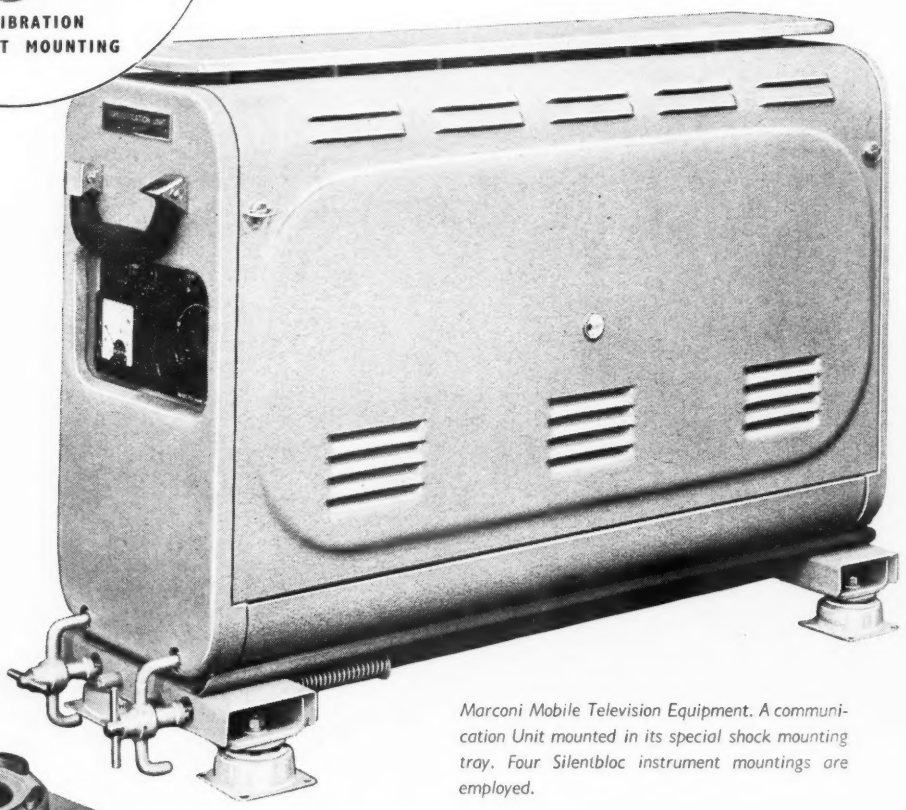

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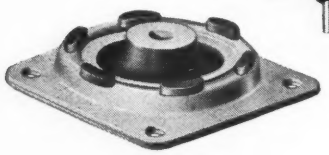

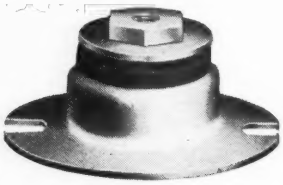

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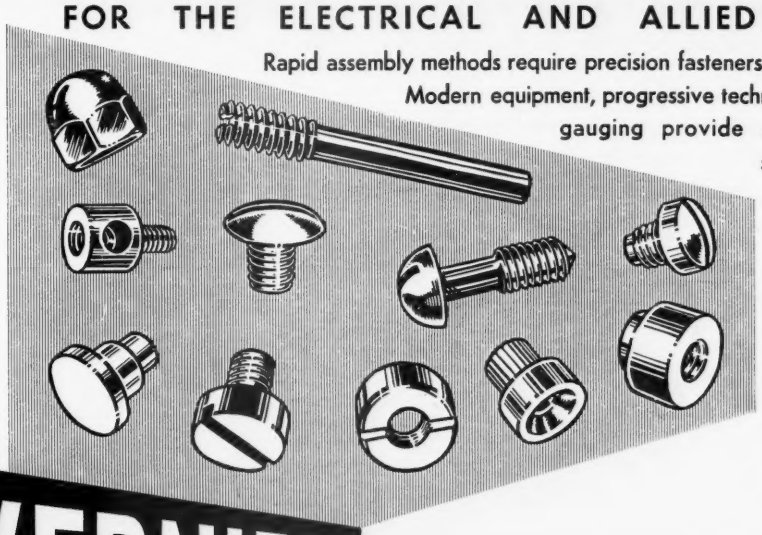

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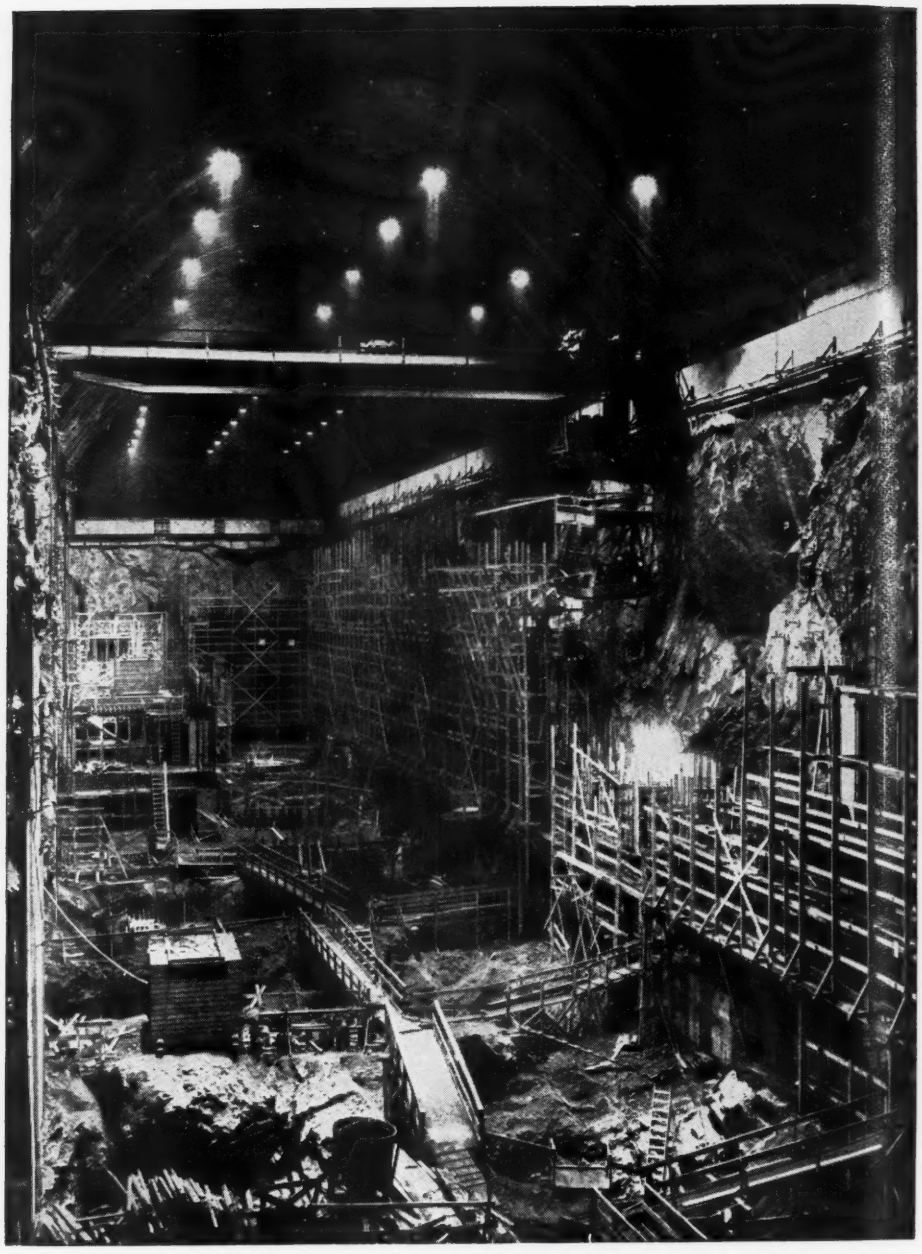

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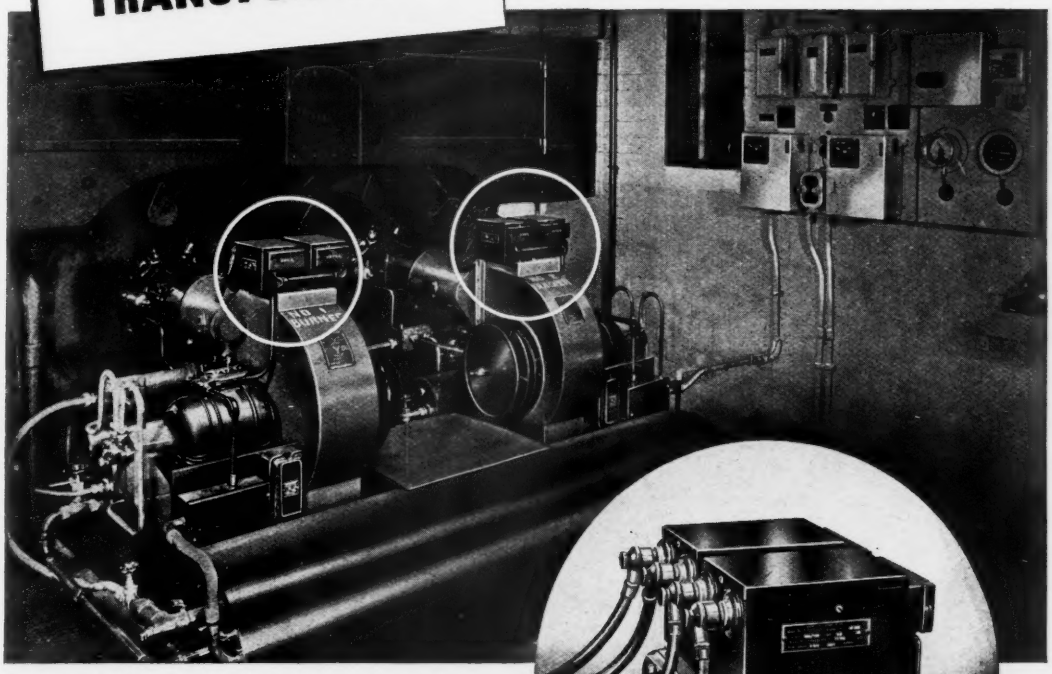
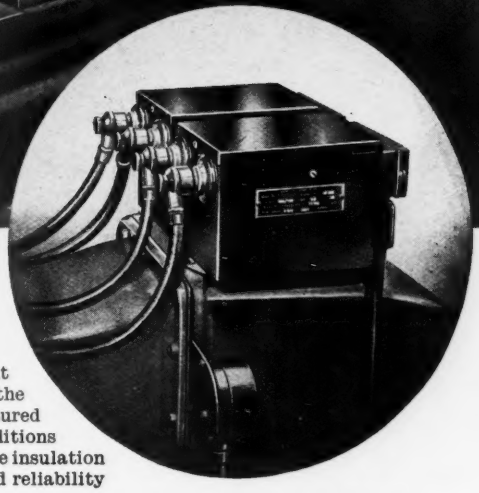


Automatic Boiler Installation by Combustions Ltd.



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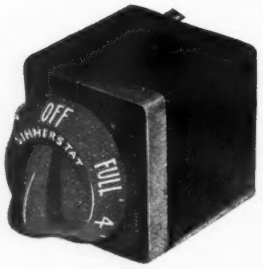

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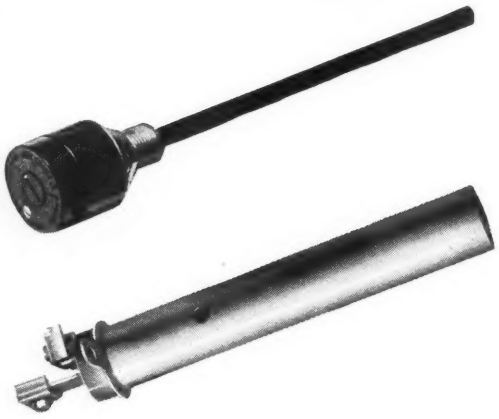
THE SUNVIC OVEN THERMOSTAT

with flexible drive

THE SUNVIC *type TQA* WATER HEATER THERMOSTAT



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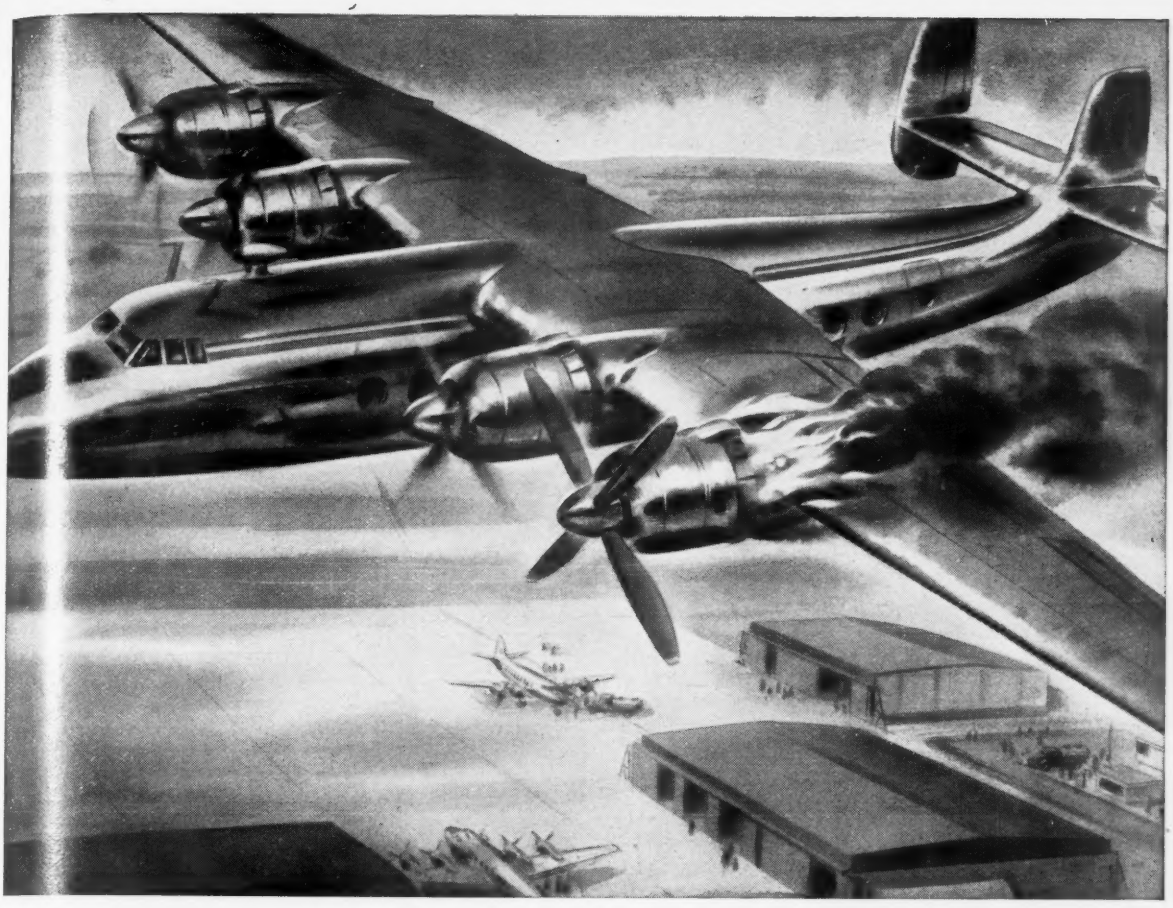

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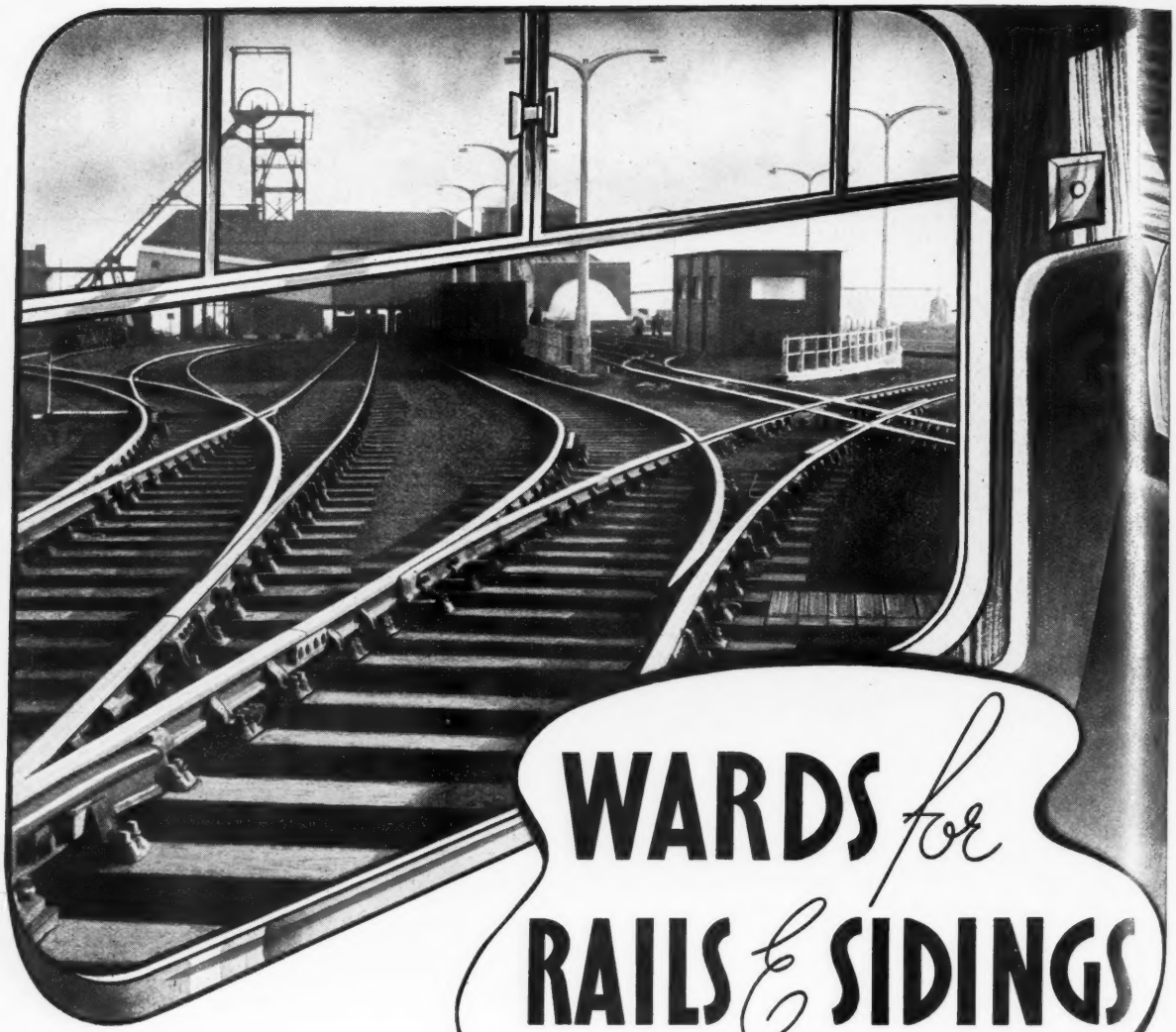

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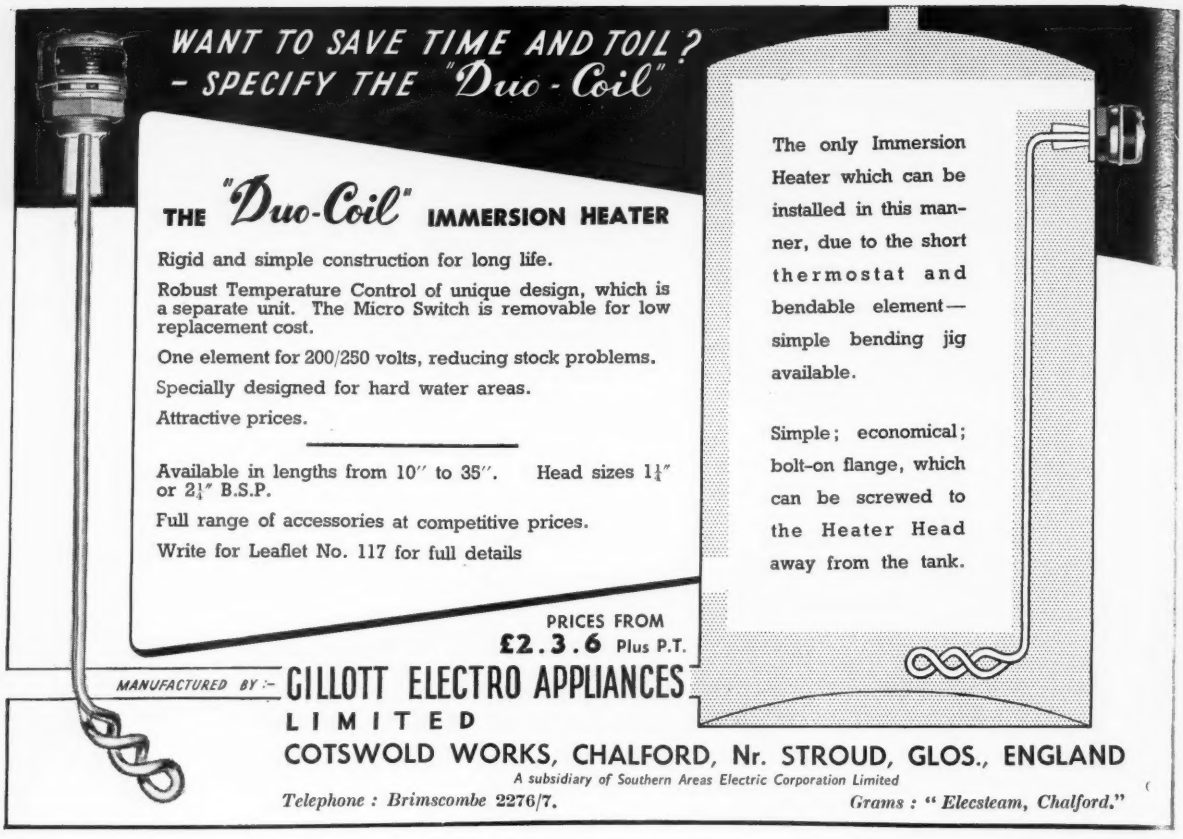

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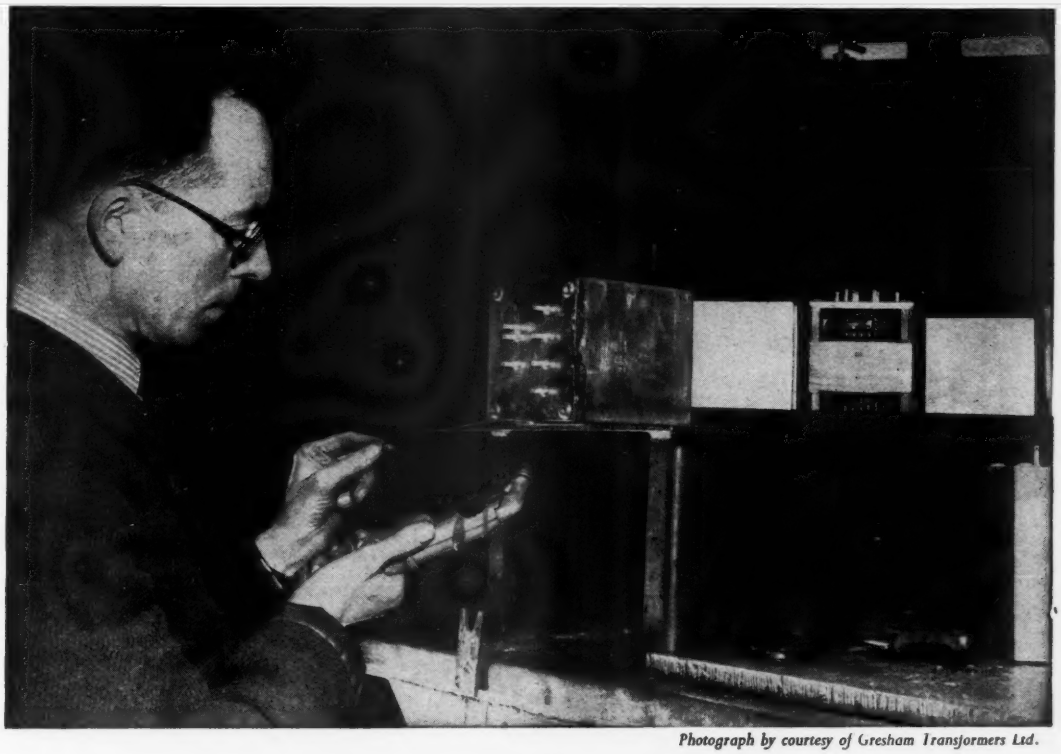
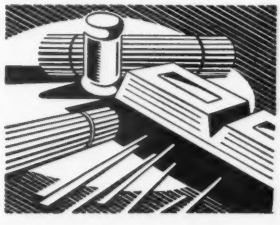


Photograph by courtesy of Gresham Transformers Ltd.

Where solder does an *important* job . . .

the electronic engineer relies on Enthoven products. Here a transformer is safely sealed in its case with Enthoven solid solder wire, just one of hundreds of different finishing operations successfully completed with Enthoven solders. Enthoven Tinmans, Blowpipe, Ingot, and Solid Wire Solders are supplied to B.S. 219 — 1949 and to customers' specifications. "Telecene" liquid activated rosin based flux made by Enthoven is the ideal fluxing medium for pre-tinning and dip soldering.



Our technical advisers and laboratory staff are available for free consultation. Technical data, descriptive literature and samples will be gladly sent on request.

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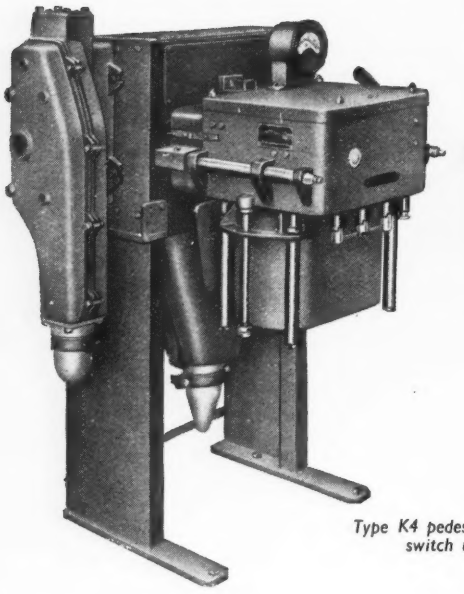

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can be provided with
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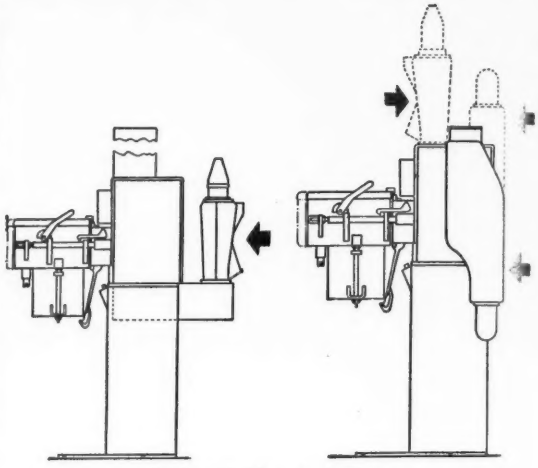
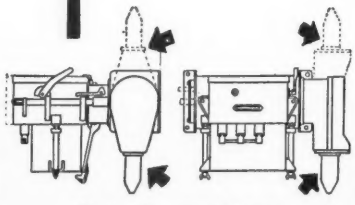
The "K" unit is of welded sheet-steel construction, incorporating horizontal drawout, fully interlocked oil circuit-breaker, the metalclad construction providing complete enclosure of all connections.

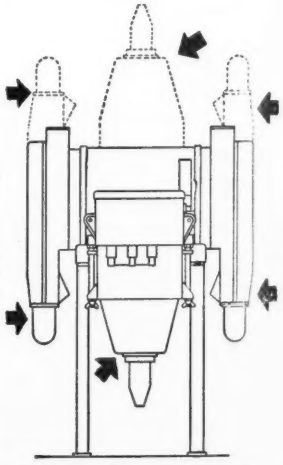


Pedestal Mounted Type

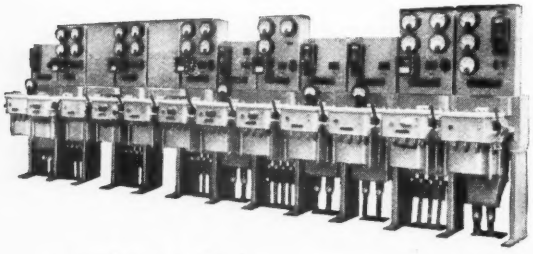
ALTERNATIVE CABLE BOX POSITIONS



Wall Mounted Type



Pedestal Mounted Type



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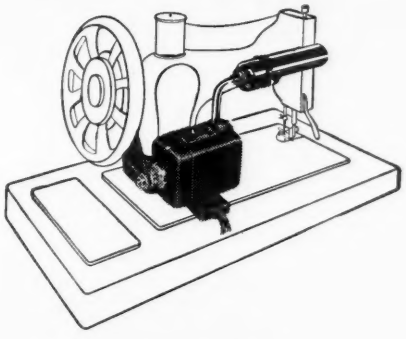

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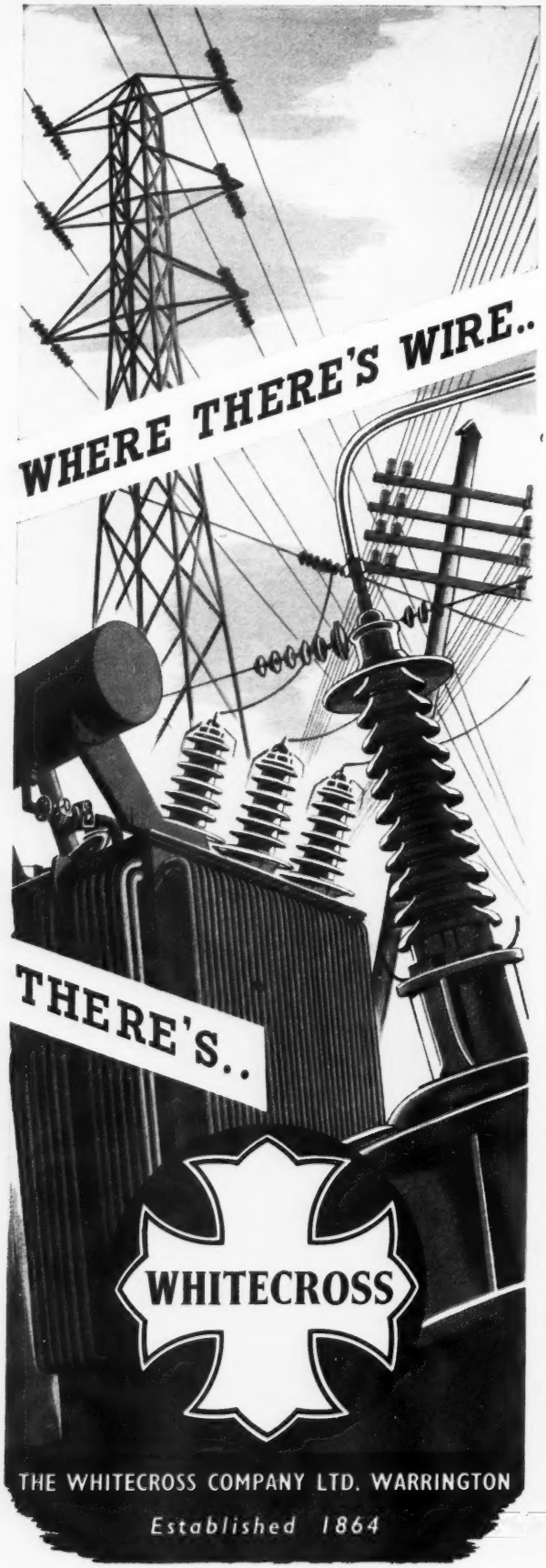

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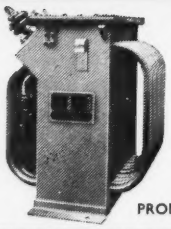

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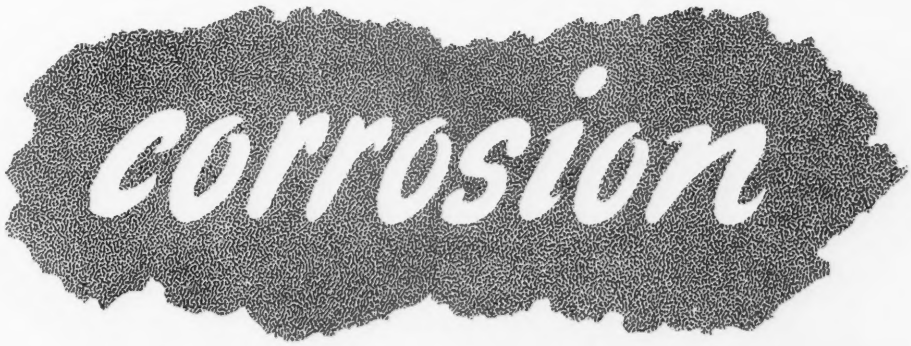

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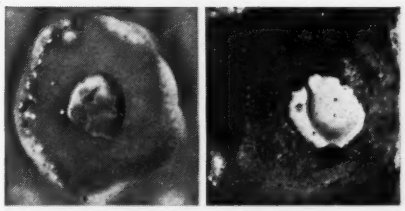

LEFT. Residue from Alcho-Re flux on soldered copper, shows no change *after three months' storage.*

RIGHT. Corrosion and deliquescence are visible on the specimen soldered with an active flux *only three days after soldering.*

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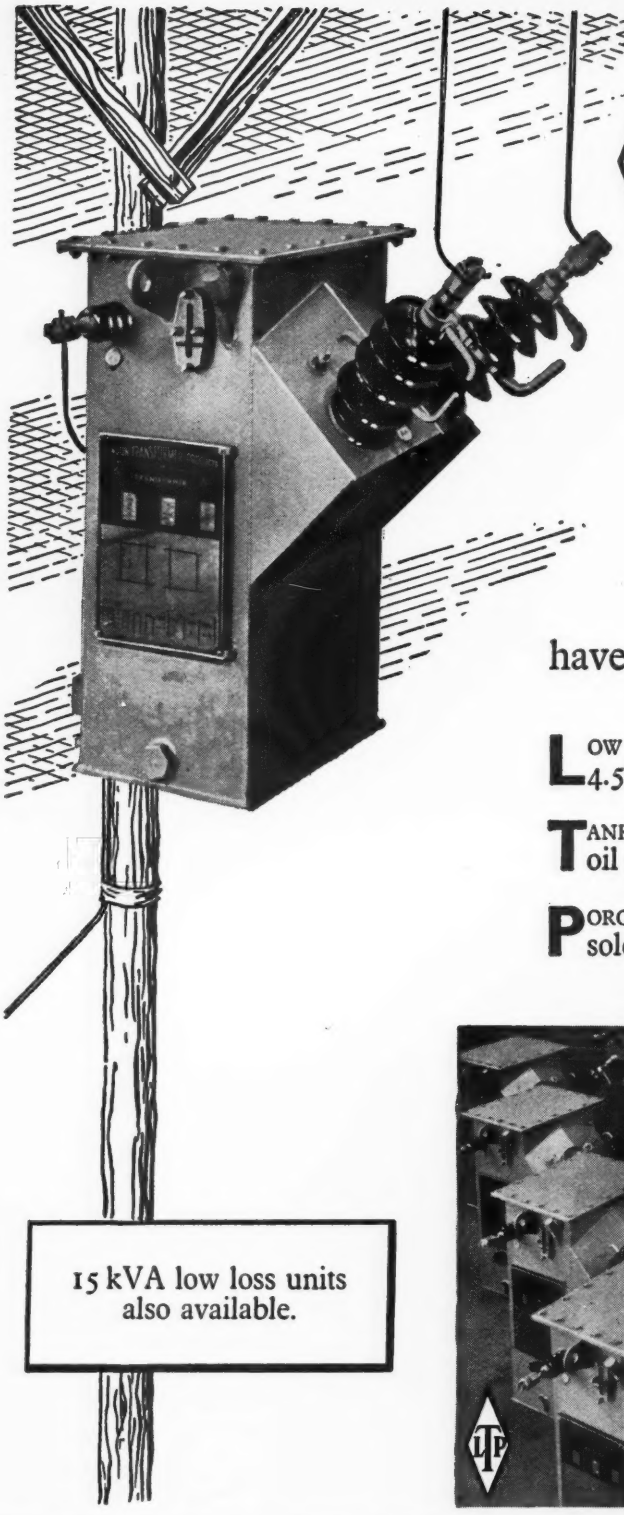

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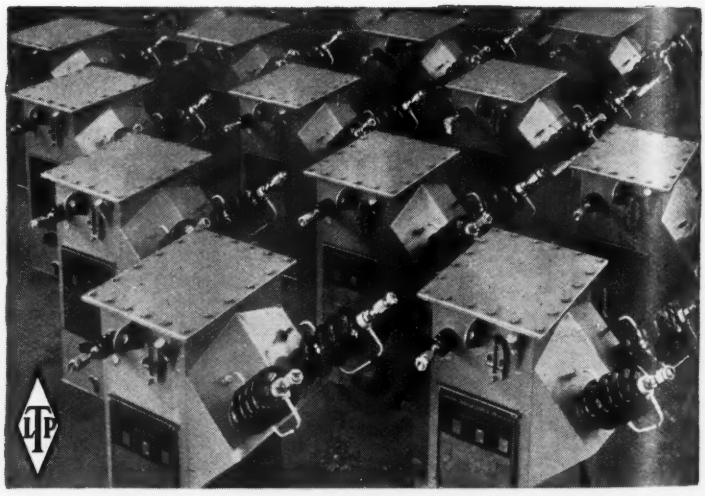

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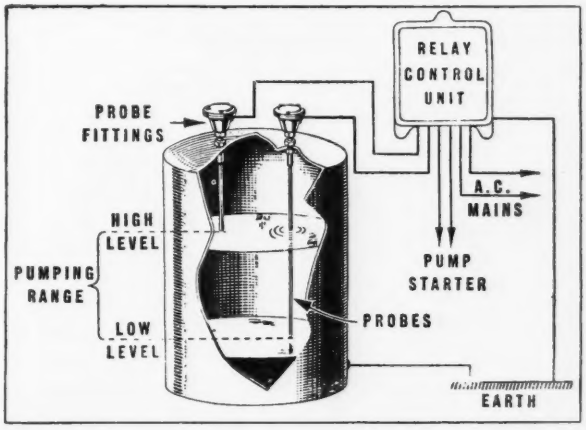

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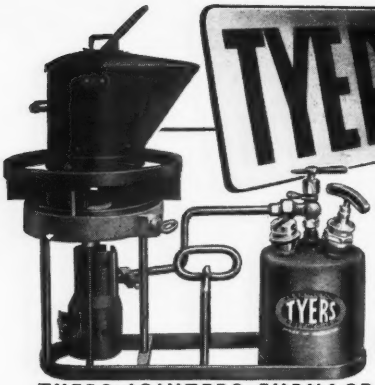

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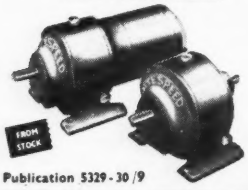

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Publication 5329-30/9

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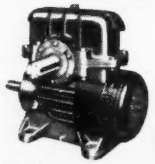
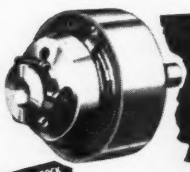


FROM STOCK

Publication 521/9

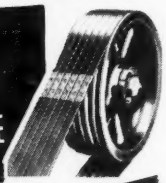
INDUSTRIAL CLUTCHES (ALL TYPES)



FROM STOCK OR QUICK DELIVERY

Publication 4740/9

COMPLETE V-ROPE DRIVES OR V-PULLEYS ONLY



Publication 852/9

FROM STOCK

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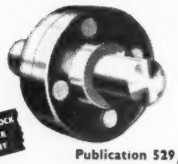
FLEXIBLE COUPLINGS (ALL TYPES)



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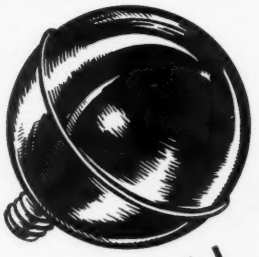

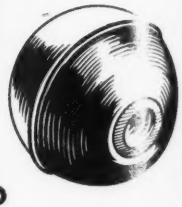

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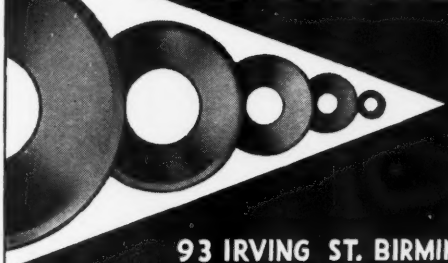

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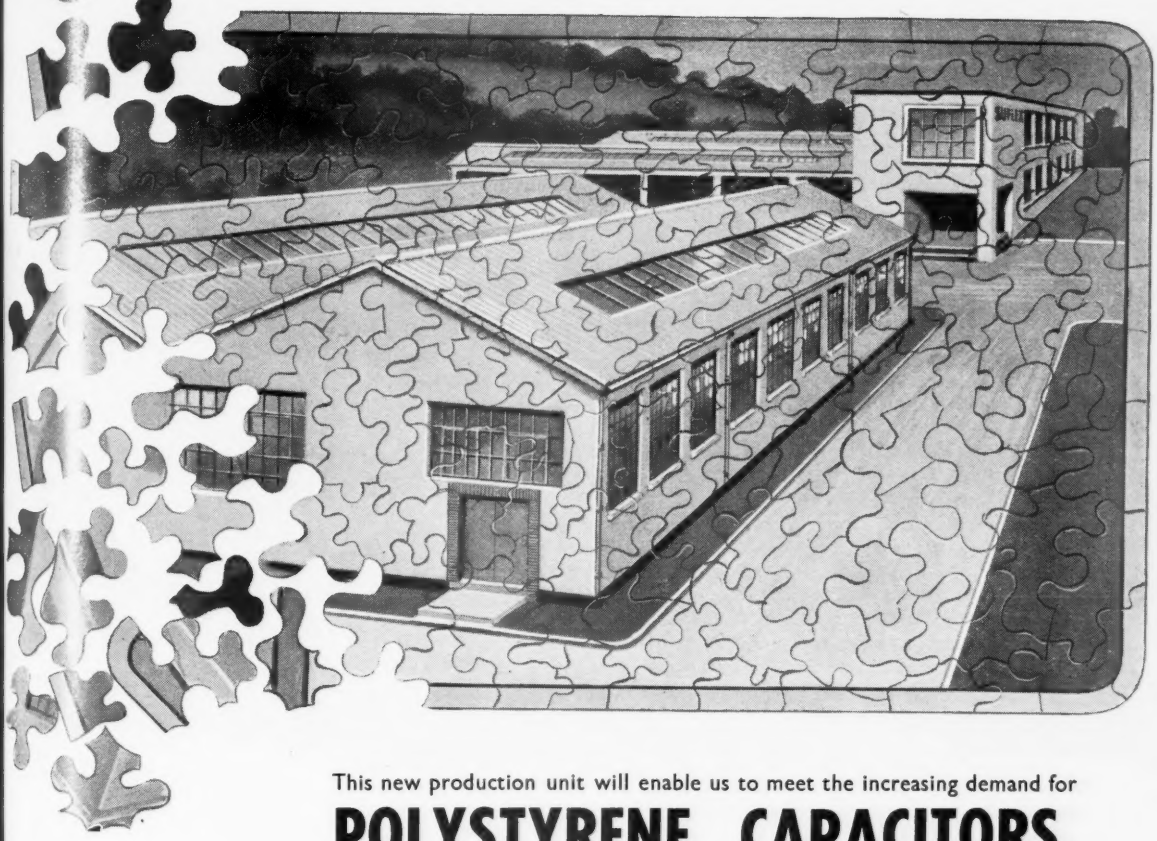

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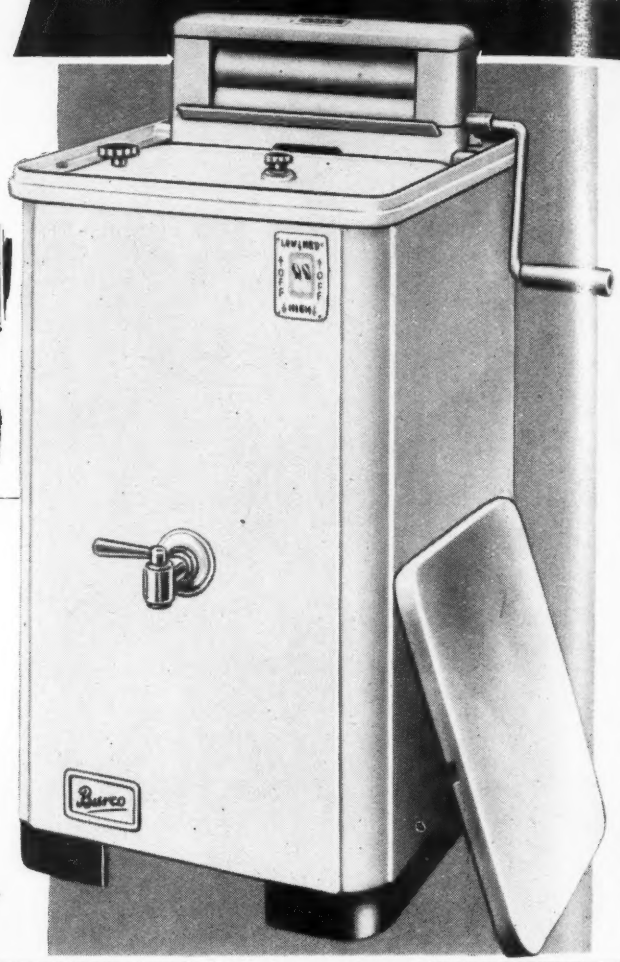

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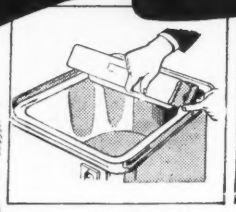
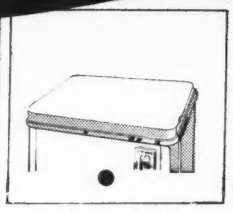
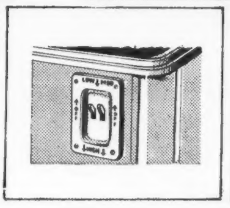


WRINGER STORAGE
The wringer can be swiftly folded inside the container and the enamelled table top makes a useful addition to kitchen equipment.



COOL TABLE TOP
of porcelain enamelled steel which enhances the appearance whilst providing additional working space.



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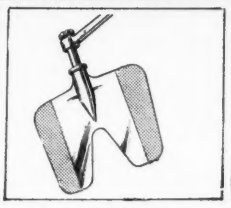
Remote switch panel of advanced design placed at working level and giving 3-heat control.



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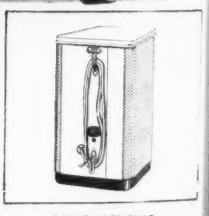

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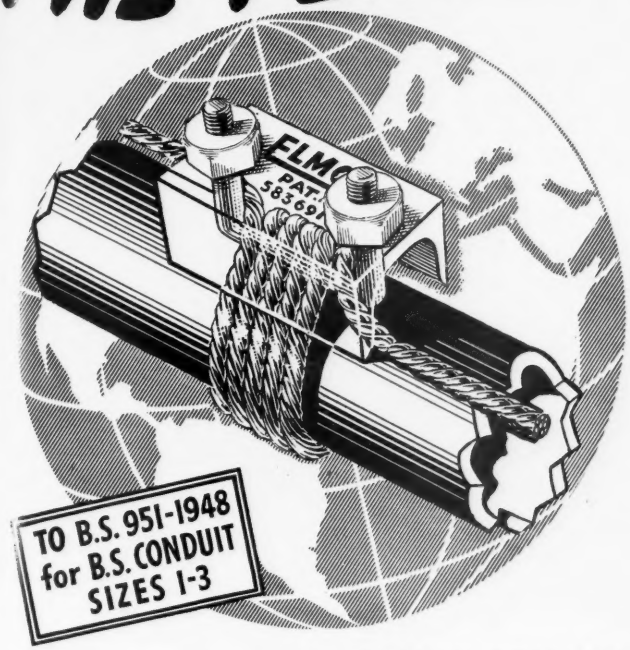

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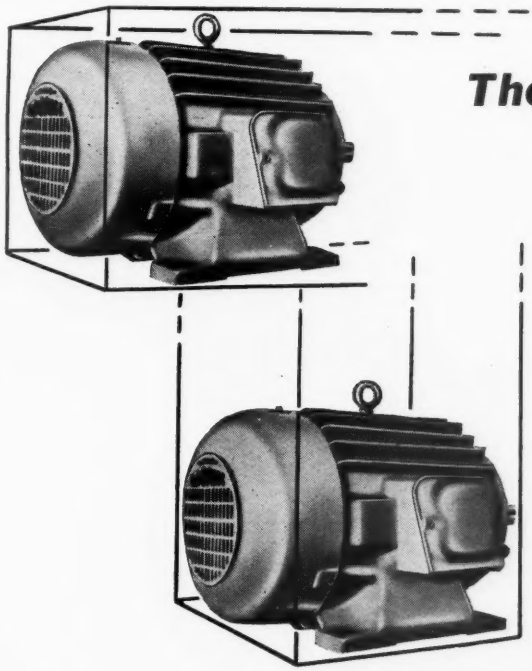

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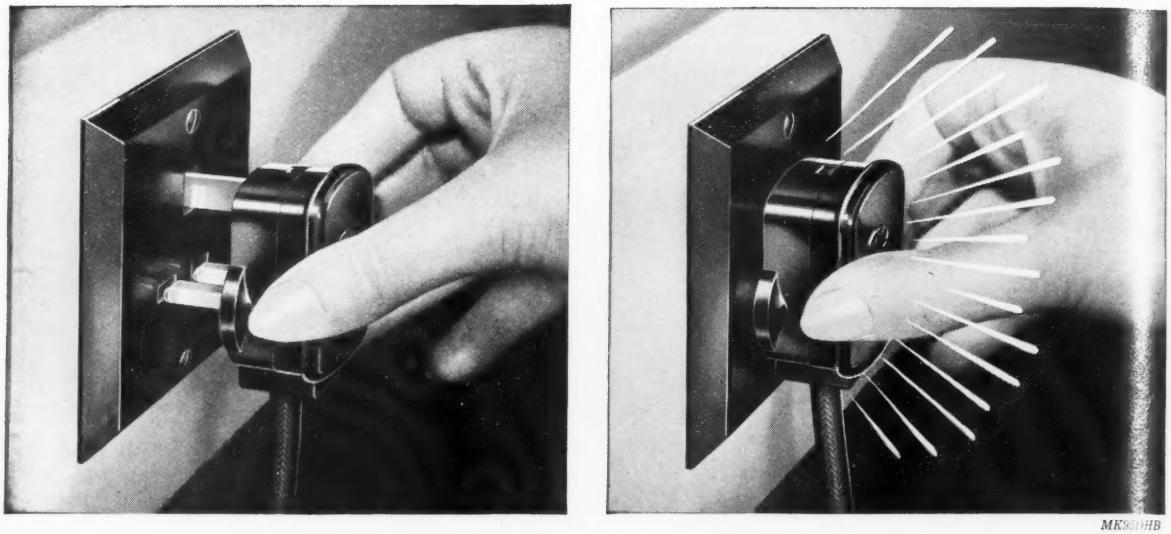

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